HOW TO LINK DSE'S TELETEXT DECODER UP TO YOUR PC!

TEST & MEASURING STRUMENTS FEATURE

NDD

Australia's Top Selling Electronics Magazine

Electronics Australia

WITH ETI

AUSTRALIAN PUBLICATION

JUNE 1993

Aust* $4.95

NZ $6.95 incl GST

NASA'S ORBITING 'SWITCHBOARD IN SPACE'

MICROWAVE PAY TV: IS IT *REALLY* INFERIOR TO DBS?

9 312966 123633

Registered by Australia Post - Publiication No. NBP 0240

Pomona Quality In Name

QFP, SQFP and SSOP Test Clips provide testable upper pins or PGA platforms for simultaneous lock-on access of every lead.

Safer DMM Test Lead Kits like this model 5901 Bench Test Kit featuring silicone insulated wire, fully insulated clips, interchangeable tips.

Plugs, Jacks, Adapters and Cable Assemblies designed for safe, positive electrical connections.

100-300MHz Oscilloscope Probe Kits featuring modular tips, fast rise times and best-signal cable lengths. 11 versatile kits.

High Quality Boxes for building integral networks, voltage dividers, attenuators for noise-free interfaces.

Differential Probe Kit safely analyzes floating signals, extends scope functionality.

World's First SQFP Test Clip locks onto 80- and 100-pin SMT devices.

SOIC and SOJ Test Clips test 8- to 28-pin SOIC devices; SOJ Quad Clip® locks onto 32-pin (7x9) EEPROMs.

FIN™/PGA QFP Test Clip provides 68- to 196-pin lock-on design with versatile top-side PGA platform.

EIAJ QFP Adapters provide .100" top-side connections while accessing 80- to 208-pin devices.

World's First SSOP Test Clips for 20- to 56-pin Widebus™ devices feature patented flexible contacts, lock-on design.

SMT/IC Test Accessories assure a reliable pin connection or link between device and instrument.

Widebus is a registered trademark of Texas Instruments.

ITT Pomona

Whether you design products or test them, whether you work in the lab or in the field, you want test accessories that assure fast, reliable results – every time – year after year.

That's why professionals like you count on Pomona.

You know high-quality Pomona probes, test leads and IC clips deliver the performance you demand, which makes testing and repairs faster. You know Pomona test accessories add value: interchangeable parts, slide-on tips and other conveniences that make your job easier. You know that, as technology rapidly grows, Pomona will keep pace with sophisticated and innovative test accessories so you can stay on the cutting edge.

Combine all this with selection and availability, and you also know why Pomona continues to be the world's leading supplier of quality test accessories.

Nobody beats Pomona in delivering price/value performance. We use the finest quality materials and manufacture our test accessories to exacting tolerances.

Pomona 1993 Catalogue now available at K.C. Electronics.

K.C. warehousing and distribution is centralised, certified to AS3902. Their MIS system is on line, real time and allows order entry and other processing from every sales office. These systems facilitate a 24 hour turnaround Australia wide.

For further information call your nearest K.C. Electronics office now.

AS 3902/ISO 9002 QUALITY SYSTEM CERTIFIED

KC ELECTRONICS

A Unit of GEC Australia Ltd.

READER INFO NO. 1

No. 3/1-7 Balaka Place, Bundoora, Vic. 3083 Australia. P.O. Box 307, Greensborough, Vic. 3083 Aust.
Melb. Tel: (03) 467 4666, Fax: (03) 467 7183 Sydney Tel: (02) 898 0422 Fax: (02) 898 0836
Adel. Tel: (08) 223 1222 Fax: (08) 232 5768 Perth Tel: (09) 381 4040 Fax: (09) 381 4033
Bris. Tel: (07) 252 3876 Fax: (07) 252 2924 Auck. N.Z. Tel: (09) 526 0107 Fax: (09) 525 7923

Electronics Australia WITH eti

Volume 55, No.6

June 1993

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Australian panel speaker

This month Louis Challis reports on the new HP-4 Panel Speaker, designed and manufactured by South Australian startup Lorpen Audio. With a novel and unorthodox design, it delivers impressive performance. Louis' review begins on page 12...

Superfast processor chip

The Siemens R&D Centre in Munich, Germany has developed a processor chip which runs at 40 gigabits/sec. See News Highlights, page 101.

On the cover

An artist's depiction of NASA's TRDS-6 satellite, when it's fully deployed in orbit. It forms part of the 'orbiting switchboard' Tracking and Data Relay System, which Kate Doolan describes in our feature story starting on page 18. (Illustration courtesy TRW Inc.)

Video and Audio

Features

Projects and Technical

Professional Electronics

Columns and Comments

Departments

MANAGING EDITOR
Jamieson Rowe, B.A., B.Sc., SMIREE, VK2ZLO
FEATURES EDITOR
Peter Murtagh, B.Sc, Dip.Ed.
TECHNICAL EDITOR
Rob Evans, CET (RMIT)
TECHNICAL CONSULTANT
Peter Phillips, B.Ed., Dip Ed., ECC
CONTRIBUTORS
Neville Williams, FIREE, VK2XV
Jim Lawler, MTETIA
Arthur Cushen, MBE
Tom Moffat, VK7TM
Peter Lankshear
Louis Challis
Major Al Younger (USAR, Ret.)
SECRETARY
Ana Maria Zamora
DRAFTING
Karen Rowlands
COVER DESIGNER
Clive Davis
PRODUCTION
Patrice Wohlnick, Mal Burgess
ADVERTISING PRODUCTION
Anthony Macarounas
CIRCULATION MANAGER
Michael Prior
PUBLISHER
Michael Hannan
ADVERTISING MANAGER
Selwyn Sayers (02) 353 0734, Fax: 353 0613
HEAD OFFICE - EDITORIAL
180 Bourke Road, Alexandria, NSW 2015
P.O. Box 199, Alexandria 2015
Fax number: (02) 353 0613
Reader Services: Phone (02) 353 0620
Subscriptions enquiries: phone (02) 353 9944
Book Shop enquiries: phone (02) 353 9944
INTERSTATE ADVERTISING OFFICES
MELBOURNE: 504 Princes Highway, Noble Park, Vic 3174. Phone (03) 795 3666.
Fax: (03) 701 1534, Nikki Roche.
BRISBANE: 26 Chermside Street, Newstead, Qld 4006. Phone: (07) 854 1119.
Fax: (07) 252 3692, Ken Yates.
ADELAIDE: 98 Jervois Street, Torrensville, SA 5031. Phone: (08) 352 8666,
Fax: (08) 352 6033, Sue Bowshall.
PERTH: Allen & Associates, 54 Havelock Street, West Perth, WA 6005. Phone: (09) 321 2998,
Fax (09) 321 2940, Tony Allen.
UNITED KINGDOM: John Fairfax & Sons (Aust), 12 Norwich Street, London, EC4A 1BH.
Phone: (71) 353 9321, Fax: (71) 583 0348
ASIA: Headway Media Services Ltd, Room 2101, Causeway Bay Centre, 15-23 Sugar Street, Hong Kong. Phone: 516 8002,
Fax: (862) 890 4811, Adrian Batten.
ELECTRONICS AUSTRALIA is published by Federal Publishing Company a division of Eastern Suburbs Newspapers Partnership, which is owned by General Newspapers Pty Ltd.
A.C.N. 000 117 322
Double Bay Newspapers Pty Ltd.
A.C.N. 000 237 598
and Brehmer Fairfax Pty Ltd.
A.C.N. 008 629 767
180 Bourke Road, Alexandria, NSW 2015.

Printed by Macquarie Print, 51-59 Wheelers Lane, Dubbo NSW, 2830, phone (068) 843 444, for Federal Publishing Company.
Distributed by Newsagents Direct Distribution Pty Ltd, 150 Bourke Road, Alexandria, NSW 2015. (02) 353 9911.
The Australian Publication emblem on the front cover of this magazine is there to signify proudly that the editorial content in this publication is largely produced and edited in Australia, and that most of the advertisements herein are the products and services available within Australia.
ISSN 1036-0212
*Recommended and maximum Australian retail price.

LETTERS TO THE EDITOR

Relay station ID's

In the March 1993 issue of *EA* I noticed a letter from Kevin Reynolds asking how radio networks can remote start ID's and commercials in radio stations taking a program from another source.

This is done using standard relay closures to remote start anything from conventional cart machines to any system that uses hard disk audio storage technology.

Our service operates under the banner of ARNSAT — Australian Radio Network Satellite Service — and is part of the Albert Group housed with 2UW in Neutral Bay, Sydney. We provide our own overnight music programs totally separate to 2UW — these are tailored for our customer stations needs and are formatted to target 20 to 40 years olds.

We have been networking via satellite since 1987 and now have some 130 receive sites in operation. In January 1992, the service was upgraded to an all digital signal using the ComStream system.

Allan Rosebuck,
Operations Manager, ARNSAT,
Neutral Bay, Sydney.

Comment: From data sent with Mr Roebuck's letter, it appears that compressed digital audio (stereo) is sent by satellite link with control data, to the remote stations.

WESAT interference

I have read of your trials and tribulations with regard to receiving VHF weather satellite pictures in the Sydney region. I have spent a considerable amount of time attempting to clear a path through the forest of EMI that exists here. I am in an inner suburb, in close proximity to high powered television transmitters, and under the main north-south runway flightpath.

A primary problem exists with the vision carrier of Channel 2 (64.25MHz) and the sound carrier of Channel 9, (201.75MHz) — the difference frequency being 137.5MHz, a primary NOAA frequency. Without a fairly selective dual filter at the pre-amplifier input, all I can hear is Channel 9 audio.

After experimenting with various coaxial and helical filters, I have found an arrangement which suits my particular setup, and which may be applicable to others. This also appears to be useful against aircraft transmissions, which are often in close proximity.

However, I still have one problem, which some of your readers may have experienced, and which I would dearly love to know the source of. On weekdays between 7am and 7pm, approximately, there is an irregular burst of 50-100Hz modulated rough tone sweeping through the satellite band, totalling obliterating the satellite signal, and resulting in loss of picture synchronisation; the period of the signal is about 10-15 seconds, its duration about 2-3 seconds. It sounds like a thermostat, or some other arcing device — do any of your readers have the same trouble?

David A.R Brown, VK2DZB,
Hunters Hill, NSW.

Heatsink danger?

I am concerned that some heatsink compounds on the market and found in consumer electronic equipment may contain Beryllium oxide. Although an excellent thermal conductor, this chemical is known to be dangerous to health.

Can you or any of your readers reassure me that all such heat conducting pastes are completely safe?

Winston Nickols,
Penguin, Tasmania.

Comment: We certainly can't give you such as assurance, Winston, but some of our readers or advertisers may be able to clarify the situation.

Satellites obsolete?

I feel I must write to you concerning your editorial in EA February 1993 edition on satellite communications. I can empathise with you in your enthusiasm for using satellites for TV transmissions to the outbacks and a few other places. However, I should point out that even as far back as 1986, the use of satellites for telephone and data communications was seen as obsolescent technology by many communications exports around the world.

Telecom Australia has always opposed the use of satellite technology for Australia. And when one reflects on the costs involved in achieving what has been done so far in this field, and compares this with what could have been achieved in, say, laying optic fibre throughout the continent; then we have paid a dear price for comparatively little gain. Telecom could

have provided an individual optic fibre cable to almost every outback homestead, giving them superb both-way communications, plus all the TV channels they could handle, for the money that has been spent on satellites.

The other aspect of satellite communications that makes it an obsolescent technology is the horrendous time delay between transmission and reception of a signal. This time delay means that satellites are useful only for one-way communication, such as TV; and not for telephone use.

You yourself must have experienced one of those dreadul conversations on an overseas call where you have to wait several seconds to hear what has been said in reply. And of course, this delay compretely negates satellites for modern digital traffic, particularly at the speeds now being used.

Satellites have their uses — navigation, weather pictures etc., but I do not believe we, the Australian telephone public, should be having to find the money for the continuation of this technology. For your information, I was an employee of Telecom Australia for 40 years, 30 of them as an engineer on switching equipment and networks.

Murdoch Finlay, MIE Aust
Highton, Vic.

Satellite broadcasts

I have recently been in Asia and watched the new Hong Kong-based satellite TV channels. The BBC programmes and CNN are available here and give a tremendous feeling of regional and global communication. We are used to time zone corrections within Australia, but to see a time zone with a nations name attached is interesting.

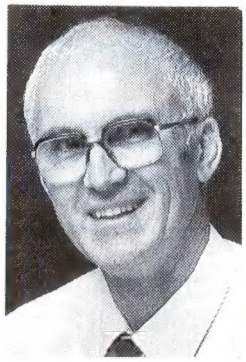
The main point is, that the broadcast satellites hang over the equator, and therefore if a transponder were pointed at the East and West of Australia, we could view these same transmissions. However, unfortunately they do not relay to Australia.

It would be nice to feel part of the Asian region, and hopefully, in the future, transmissions to the southern hemisphere from international broadcasters will cross our boundaries. Once the broadcasts are in place, I am sure the equipment to view them will be purchased!

Andrew Hope,
Forrest, ACT.

Comment: I agree, Andrew. My understanding is that a satellite called Pan-AmSat PAS-2 will begin beaming transmissions to the South-East Pacific (including Australia) in the next couple of months. So you may not have to wait long! ❖

EDITORIAL VIEWPOINT



Coming: A truly international standard for digital video & audio...

As we report in our news columns this month, the ISO/IEC Moving Picture Experts Group or 'MPEG' held a meeting in Sydney recently, to define the 'Video Main Profile' of its new MPEG-2 standard for compressed digital video. As I understand it, this is the basic configuration which will apply for standard-definition TV and video, as opposed to the high-definition and low-definition variants.

The meeting was also reported to have made 'important progress' towards developing a multi-channel audio standard for MPEG-2. In addition, an initial specification emerged for the way compressed video, audio and data will be multiplexed together into a single master 'stream' of data packets for transmission, storage and 'access management' (which basically means 'the ability to ensure the signal can only be decoded by those who pay the appropriate fee').

From an announcement made by MPEG following the meeting, it appears that everything is 'on schedule' for it to produce Committee Drafts of all three parts of the MPEG-2 Standard by November this year — ready for voting by the member countries. This means that if all goes according to plan, MPEG-2 should be established as the comprehensive, internationally agreed-upon standard for compressed digital video/audio/data, by early next year.

The implications of all this for we ordinary mortals are really quite profound. Despite what you may have been led to believe, most of the technology needed to implement MPEG-2 is either 'ready to roll' or very close to it — so as soon as the technical standards are finally in place, the stage will be set for the dawn of a *whole new era* of digital TV (including Pay TV and HDTV), digital video recorders, digital videodisc players, digital stereo radio, digital audio recorders and so on.

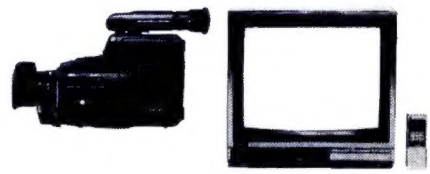
Basically, we're likely to see the world's existing mish-mash of analog TV systems (like NTSC, PAL, SECAM and MAC, in their many variations) replaced with a single, unified and 'open ended' global digital system which should serve the world's needs for many decades to come. And this single system is likely to be used not only for TV and video as such (transported by whatever medium), but for associated things such as computer graphics, 'multi media' and animation; electronic photography; desktop publishing; 'video phones'; and even the next generation of fax machines. In fact many of these technologies are already converging, in anticipation of this development.

So MPEG-2 is not just a system that will be used for Pay TV via satellite. What's coming is a complete revamp of the way the world handles moving and fixed images, with or without accompanying audio.

Very soon now, your TV set and personal computer are likely to merge, and offer a range of possibilities you may not have thought possible...

Jim Rowe

What's New in VIDEO and AUDIO



'Super flat' speaker cable

A new high quality flat speaker cable is now available in Australia, via Architectural Audio Design. Manufactured in the USA by Nordost, 'Flatline' cable takes advantage of a new technology for extruding Teflon cables, originally developed for the US space program.

With a total thickness of less than 0.5mm, the cable can be run under floor coverings without leaving bumps. It uses a total of eight flat rectangular oxygen-free 99.999% pure copper conductors (two groups of four), separately encapsulated in fluorinated ethylene propylene (FEP) Teflon insulation. This produces a cable which is both rugged and flexible — it can even be used outdoors or buried in soil, without deterioration.

When used as recommended the cable has a capacitance of 6.0pF per foot and an inductance of .06uH/ft, giving a characteristic impedance of 120 ohms.

Each conductor has a current rating of 12.5 amps continuous, giving the resulting cable a rating of 50 amps continuous. The voltage rating is 300V, and the Teflon insulation allows it to be used in the temperature range from -65° to 390°F.

Despite its very different physical format — or perhaps because of it, the manufacturer claims that it compares more than favourably with any existing high-quality or 'special' speaker cable.

In fact it's boldly proclaimed to be the 'best speaker cable ever made', by virtue of lower capacitance and inductance, reduced skin effect and lower 'frequency smear'.

Further information on Nordost Flatline Cable is available by circling 181 on the reader service coupon, or by contacting Architectural Audio Design, PO Box 90 Dee Why 2099; phone (02) 968 3299, fax (02) 968 2548.

KEF commits to Australia, Asia

KEF Audio UK, one of the world's most respected speaker manufacturers, has signalled its intention to cement its position in the Asian and Pacific region by opening a regional marketing office in Hong Kong.

KH Asia Pacific is responsible for implementing an aggressive marketing strategy and distributor liaison for KEF Audio throughout Asia, Australia and the Pacific.

The appointment of Neil Wilson, an Australian with over 20 years experience in the audio industry as Regional Marketing Consultant by KH Asia Pacific ensures that Australia is a focal point in KEF's growth worldwide.

David Small of Audioworks, the Australian distributor of KEF products, met recently with the KH Asia Pacific management team and commented that he was "overwhelmed by the level of committment and investment KEF is making in our region and around the world. KEF has an enviable history and is recognised by both the industry and consumers alike as leaders in the research and development of acoustic technology."

"Neil will be working closely with Audioworks to support the KEF dealer network ensuring that customers can audition a pair of KEF loudspeakers at their favourite hifi dealer with the utmost confidence."

For further information contact Neil Wilson, C/- Audioworks; phone (02) 819 6633.

New CTV's from Sony

Sony (Australia) has added two new models to its extensive Hi-Black Trintron colour television range — the KV-2566AS and the KV-2166AS.

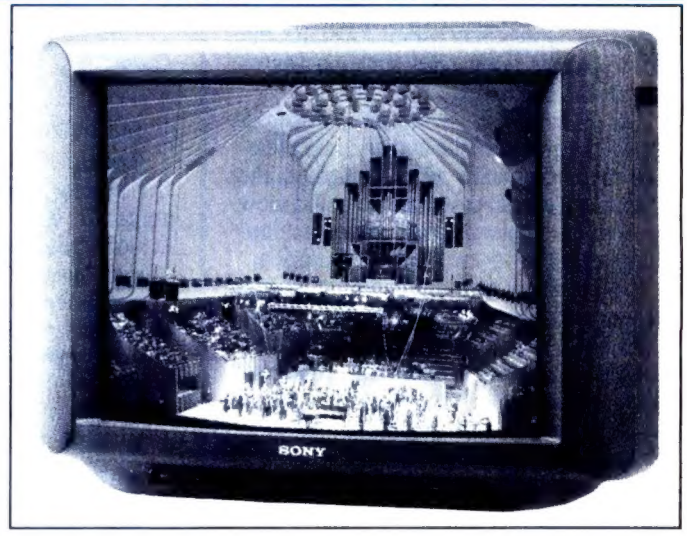
"These latest additions, combined with the model released late last year, the Sony KV-2966AS, make up the 'Theatre Series' delivering greater sound and more vivid colours than ever before," said Sony's Visual Product Manager, Ms Suzanne Hume.

"The Theatre Series has been specifically designed for family viewing. With the growing popularity of hi-fi VCRs and laser disc players, many households want to create a mini-cinema environment."

"The large screen and stereo sound quality of this Hi-Black range address the consumers growing need for greater picture and sound quality," she said.

The name Hi-Black refers to the picture tube. The screen has dark tinted glass, creating a pure black screen that helps diffuse reflection to give excellent picture reproduction even in brightly lit environments. The darker screen reproduces the colours so they appear more vibrant, bringing about blacker blacks, whiter whites, vivid red, blues and yellows.

Other features of the Sony KV-2966AS, the KV-2566As and the KV-2166SA include rear audio/video inputs with VIT for VCR connection and NTSC playback; front audio/video input; and a full-function remote. The KV-2966AS and KV-2566AS also include a rear S-Video input for high band video enjoyment.



The KV-2566AS and the KV-2166AS are 69cm and 51cm respectively. Sony's recommended retail price (RRP) for the KV-2566 is $1799 and $1399 for the KV-2166AS. The Sony KV-2966AS is 68cm and has a RRP of $2299.

Kenwood releases Home THX system

Kenwood has released a new A-V control amplifier/tuner and matching power amplifier combination which implements the THX Sound System developed by Lucasfilm for enhanced 'home cinema' sound reproduction.

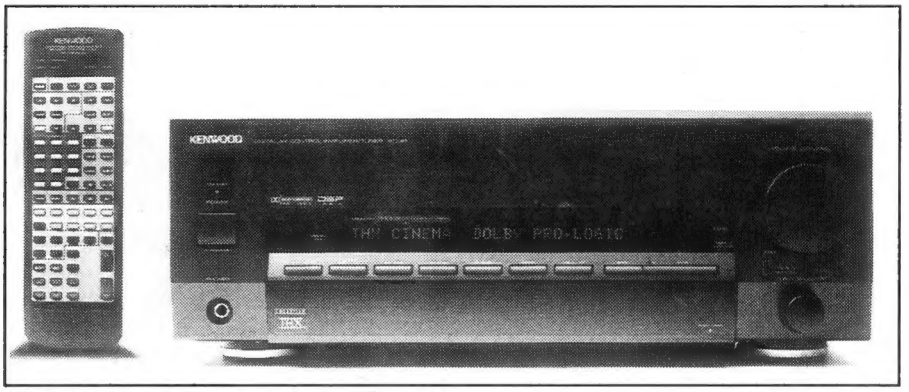
The Kenwood Home THX System couples Dolby Pro-Logic surround sound decoding with the THX Cinema Circuitry licensed from Lucasfilm, to provide theatre-grade sound reproduction from either video tapes or video laserdiscs.

Features of the THX system include three proprietary Lucasfilm techniques for sound enhancement: re-equalising of the sound, to suit a home listening environment; 'de-correlation' of the surround information, to diffuse it and give a more realistic surround effect; and 'timbre matching', to improve the tonal balance of the surround signals and match them better to the three front channels.

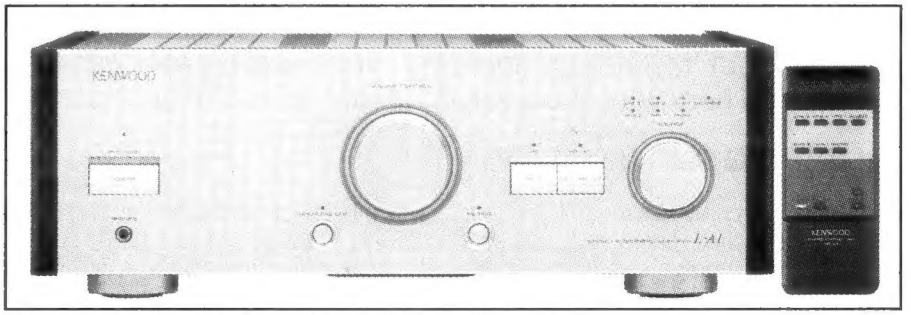
Kenwood's new KC-X1 control amplifier/tuner integrates the THX and Pro-Logic functions with an AM/FM stereo tuner. In addition, it provides A/V switching for five audio and four video signal sources, including S-VHS, and standard DSP modes including DSP Logic and Dolby 3.

The matching KM-X1 power amplifier provides no less than six 100-watt amplifier channels — one each for the front left, centre and right channels, two for surround channels and one for a subwoofer.

All channels meet the strict THX standards for output power capability and headroom.



Kenwood's KC-X1 control amplifier/tuner.



The stereo integrated amplifier L-A1 from Kenwood.

The KC-X1 and KM-X1 are covered by a three year parts and labour warranty and have an RRP of $2999 for both units. They are only available from selected Kenwood A/V concept dealers.

Among the other new products released by Kenwood are the 'L Series' L-A1 integrated amplifier and L-D1 CD player, which have been designed to become the firm's top of the range 'flagship' products for audiophiles who are able to afford uncompromised excellence in reproduction. These products are the result of several years of dedicated R&D, and incorporate many design innovations.

The L-A1 Amplifier features a 'Super C^4' input stage to minimise common-mode noise, together with a 'Quadrive' output stage configuration to provide increased headroom.

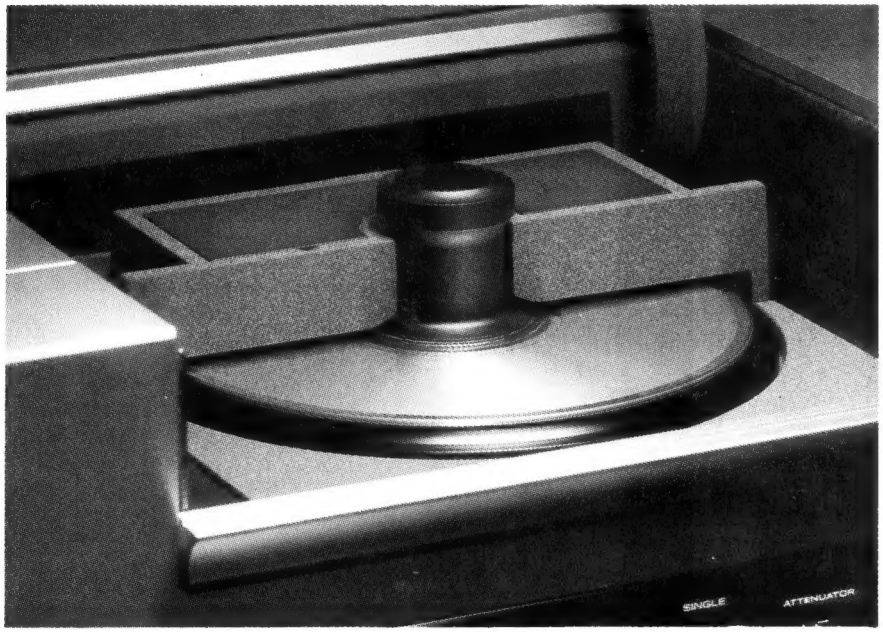
It also features a special fully shielded ultra-low impedance volume control. The amplifier delivers a rated 100W per channel into eight ohm loads, with better than .005% THD between 20Hz and 20kHz. Signal to noise ratio for the phono inputs is 92dB (MM) and 78dB (MC), and 100dB for the line level inputs.

The L-D1 CD Player features top disc loading and a direct-drive turntable for improved disc support. The laser pickup sled moves on a rugged diecast aluminium 'bridge' for rigidity, while the machined turntable and clamp weight provide 20 times the moment of inertia of a conventional disc support assembly.

The three-phase eight pole drive motor is accordingly designed to provide greater torque, and has an external rotor. The player uses independent high quality Burr-Brown D/A converters.

The L-A1 Amplifier has an RRP of $3999, while the L-D1 CD Player has an RRP of $4199.

Further information on these products is available from selected Kenwood dealers, or by contacting Kenwood Australia on (02) 746 1888. ❖



A close up of the turntable of Kenwood's L-D1 new 'top of the range' CD player. The disc sits on the turntable label down, with the laser scanning from above.

Why were the rules changed to block the use of MDS?

PAY TV VIA MICROWAVE: CANBERRA DECIDES NOT

We have Canberra to thank for the mess of TV frequency allocations in the 1950s — a tangle which provincial stations are still trying to untwist. Now it looks as though Pay TV will be subjected to the same torture, judging by Canberra's decision to block its delivery by microwave MDS, against its own policy of 'technology neutrality'. The reason given was that 'it doesn't work' — yet it's already being used here very successfully, for distribution of business and financial programming...

by BARRIE SMITH

Late January: the turkey and pudding of Christmas had barely left the system. Storm warnings had been set for another Federal election. Then, out of nowhere, came a diversion that, once again, proved that politicians should stay with baby kissing and not try to understand — nor regulate — the intricacies of broadcasting.

Steve Cosser has, seemingly, been around since the year dot: ABC current affairs host, one time owner of Channel Ten, video production company founder, and supplier of foreground and background music to the country's lifts, offices and supermarkets.

As a media operator Cosser has always grasped the essentially simpler, and frequently less painful, nettle when exploring and developing communications technology.

Over the last two years Cosser's company Australis Media has acquired a set of 23 licences from the Federal Government, allowing microwave broadcasting of television. Grandly labelled the 'Multi-point Distribution System' (MDS), it looked set as a simple, no-fuss method that could bring Pay TV to the broader population as quickly as three years before satellite delivery systems.

February broke and government tenders were out for another 12 MDS licences — in Sydney and Melbourne. Australis and others entered bids. Then, only 23 hours prior to tender closing time, the Minister for Transport and Communications announced that MDS would not be allowed to carry Pay TV until after the satellite service was up and running, or a national cable system had been laid. The press devoured the farce. Everyone entered the debate.

Fact 1: the Broadcasting Services Bill was passed by the Senate on November 4, 1992. It stated that no satellite Pay TV licences (other than for the ABC) would be issued before July, 1997. And continued: 'It is important to note there will be no restriction on the use of other technologies to deliver Pay TV such as cable or microwave (MDS)'.

Fact 2: Senator Collins himself was quoted in November 1992 as saying "Microwave services are likely to broadcast the first Pay TV".

Then, in early February, 1993 he told ABC-TV's Paul Lyneham that Pay TV was "arguably the worst possible technology in the world for this country".

On the same programme Steve Cosser countered: "The fundamental flaw with MDS is that it's available now, and it works". He added that the government's action would see the "ditching of 4000 potential jobs in calendar 1993, and rejecting $200 million of overseas investment into Australia". In his view MDS would give us Pay TV today and not 1997, received with a one-foot dish not a five-foot dish — and costing $200, not $1700.

Narrowcaster

Like Oceania TV (covered in *EA* in February last), Australis holds licences for narrowcasting to special interest groups. Australis' Newsvision is the country's first Pay TV channel.

Basically, Newsvision takes satellite feeds from overseas, interpolates local news data in graphics form and outputs

In Sydney's CBD, Newsvision's MDS programming is eagerly tapped by a range of business clients.

Australis Media's GM Adam Wells and a rooftop dish used for incoming programming from the rest of the world.

the signal via microwave transmitters to 128 business subscribers across Australia.The overseas 'feed' includes live news from NBC Nightly News; BBC Breakfast, 6pm and 9pm news; CNBC Money Wheel — a live New York-originated coverage of the action on Wall Street; the influential MacNeil Lehrer News Hour; Dow Jones-Telerate; Financial Times Business Weekly; plus New Zealand news from Network One, as well as English language news from Berlin. Newsvision is obviously not a ratings winner directed to Mum and Dad, but is eagerly consumed by the Australian business world.

Paying customers include the ANZ, State Bank of NSW, Barclays, Sydney Futures Exchange and hotel groups such as the Park Royal, Hyatt and Regent — viewership is estimated currently at 14,000. At time of writing the whole matter was in the legal process, with Cosser demanding the Government set aside the direction given to the Australian Broadcasting Authority not to issue MDS Pay TV licences, thereby allowing 'broadcasting' via MDS.

Australis Media's tiny control room houses satellite receivers, standards converters and six Betacam play/record VTRs. The Betacam play/record VTRs are used for programme capture and later rebroadcast. Production Manager David Spencer is seen at the controls.

When the dust settles — and if Australis wins the action — application for Pay TV licences should take place on a 'straightforward, over the counter basis'.

At this point the company intends to create a franchise network of MDS licensees across 200 towns and cities. Twelve channels are envisaged, carrying such material as packaged movies, a children's channel, sports channel, nostalgia channel and so on; interpolated into these feeds would be Australian programming.

The local franchisees would then reticulate the programming to homes. Cosser expects the services to constitute a viable alternative to the established networks and 'compare favourably' in cost to the proposed satellite system.

Tight operation

On air 24 hours a day, seven days a week, Newsvision is up and running in the Castlereagh Street, Sydney HQ of Broadcom — Cosser's production company. The 15 staff are crammed into a jumble of office desks, with the actual operational centre housed in a room no more than 10 square metres in area.

Australis GM Adam Wells describes the setup as basically a lean one, "not a big operation" — adding "the facilities and staffing levels do not compare with that of a broadcaster".

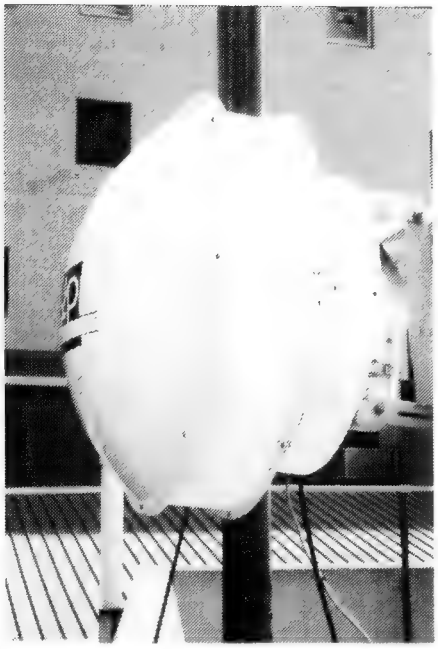
He continues: "We've set up a very, very lean but efficient infrastructure; you can do it with a fraction of the overheads of a broadcast station. This assists the cheapness to the customer at the other end."

"We have a satellite dish on the roof. The signal is brought down to two standards receivers, standards converted and sent directly to air — or on occasions recorded onto Betacam SP, edited, and sent out as a delayed broadcast.

Most programmes arrive here as NTSC signals because they travel clockwise from the Los Angeles gateway, even if they have emanated from London. The programming goes straight out on a microwave link from our roof across Pitt Street, then up to Centrepoint Tower. From Centrepoint it's sent to subscribers via a 100-watt MDS transmitter, with a 50km radius."

"At the end of every half hour we inject local financial data via a fibre-optic link from Dow Jones-Telerate — up to the minute news and financial data service, cross rates, dollar rates, markets, commodities."

"The programming goes out live, but is also recorded and replayed throughout the day because of the Northern Hemi-



A rooftop mounted microwave link bounces Newsvision's programme signal across Pitt Street to another rooftop.

satellite dishes are far from invisible, with diameters of around a metre. Wells showed this writer one model of MDS receiving dish — made by Mitec in Brisbane — that barely spanned a hand. Cost was indicated at around $100 — all up.

Wells described the overall MDS cost element as being based on "a number of structures":

"We've been nominated by the Australian Hotels Association as 'preferred supplier'. To be accredited to that position a rate was struck of 17c per occupied room per night. It's no secret, because it's a very competitive rate. Not only a cheap rate, but they're only paying for it when the rooms are full. It works well for them, because if they're a small hotel they've got a smaller fee."

"For the corporate side, depending on contract length, on monitors, the average fee is around $4000 - 5000 per annum."

"At this point the domestic market is not catered for", Wells explained, but added: "legally we can". In Wells' view, "regardless of whether MDS Pay TV happens — or doesn't — we can still go to the homes as a narrowcaster".

"We would set up an MDS head end so it comes down via satellite or via landline or via microwave. That's the beauty of MDS — it encourages regional diversity, regional control over their television, injection of local material, advertising, news and the like, serving the local community."

User satisfaction

Asked about customer satisfaction, Wells offered an anecdote which encapsulates the unique attraction of the service to business:

"A guy rang us from Florida who had been looking to come here for a business holiday, but then discovered a number of his favourite financial TV shows were not relayed via free to air stations in Australia.

So he literally said 'That's it, I'm not coming until I can have my fill of financial programming'. He found us, called to make sure we carried the programming — then travelled."

"In the business area, Newsvision is putting a lot of emphasis on increasing Asian programming. I see that as a value added factor to our service."

Control room peek

Chief Engineer David Jupp has established a raft of equipment in the cramped space: a Winersat satellite receiver, STANDI NTSC/SECAM to PAL standards converter and an Amiga 3000. Six Betacams — SP and standard — are in place for off-satellite recording, editing and on-air replay. MDS has been used as a data transmission method — AAP is understood to be doing it currently.

Australis is now looking at transmission of other data services in the vertical blanking period — similar to Teletext, with maybe even interactive functions akin to Compuserve.

"It doesn't work"'

In the flurry of words which flew to and from Senator Collins' office, the latter unfortunately destroyed the few remaining shreds of his technical credibility on the subject by declaring:

"All the advice I have had and all the advice I still have is that this technology just doesn't work... it gets interfered with by houses, trees, storms and all sorts of things."

It would be fair to point out that satellite transmission is likewise unassisted by intervening buildings, trees — and is known to suffer severely from rain storm interference.

Microwave is not new, and is a vital tool used by Australian stations for many years to bring remote happenings to air.

Every night we see news links via the technology. Every day of every cricket match is carried by microwave from the ground to the TV station. Politicians in Canberra, should they decide to tune to the ACT programming of Wollongong's WIN-TV, may well watch a signal brought to the plains of Monaro from the Illawarra coast. Mainland programming is bounced across Bass Strait for rebroadcasting to Tasmanian viewers. All by microwave...

In the USA, many MDS Pay TV stations operate — from Aberdeen in South Dakota to Yuma in Arizona. Czechoslovakia, France, Greece, India, Canada, the UK, Brazil — all have operating MDS stations. So why not in Australia?

Perhaps the problem lies in Cosser's theory: "The fundamental flaw with MDS is that it's available now, and it works." ❖

A second microwave link then relays the signal to the Centre point Tower, for primary distribution within a 50km radius.

Table 2: Technical Comparison

	MDS	DBS Satellite	Fibre/Optic Cable
Quality of signal?	Better than free-to-air	VHS standard	Better than free-to-air
Size of antennae	10 - 50 cm	90 - 120cm	Nil
Require street digging etc	No	No	Yes
Local Council approval required	No	In many cases	Yes
Able to inject local ads/stories	Yes	No	Yes
Affected by topography?	Yes	Yes	Yes
Affected by trees in installation site?	Yes	Yes	Yes
Concrete foundation required	No	Maybe	No
Installation by home handyman?	Yes	No	No

LORPEN AUDIO HP4 HYBRID PANEL SPEAKER

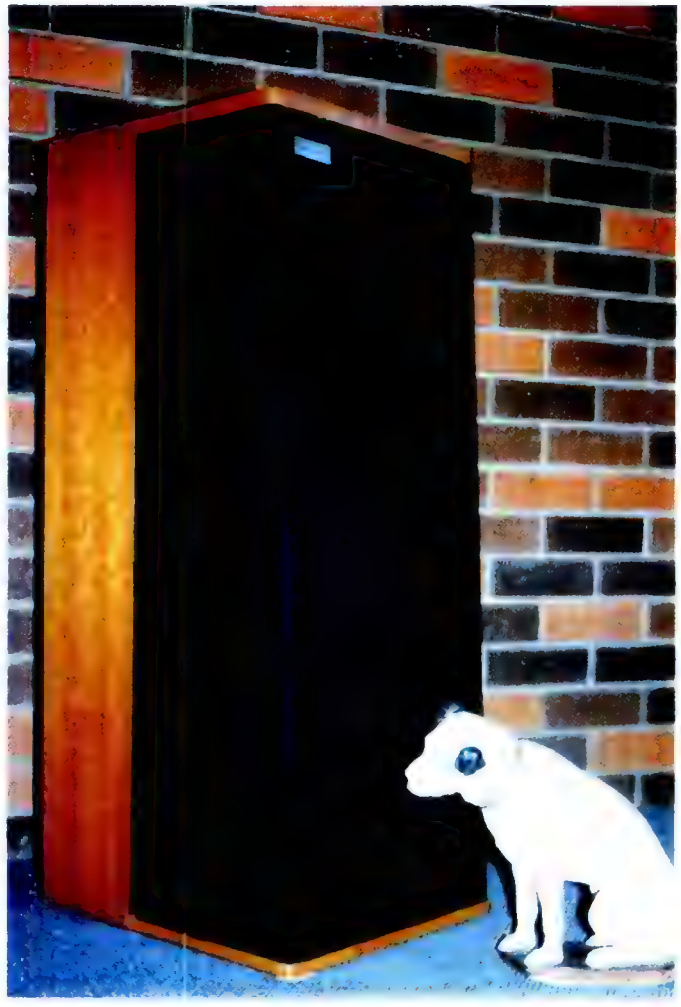
This month, Louis Challis was able to test a pre-production sample of a new and innovative 'panel' speaker system which has been designed and is being manufactured in South Australia. Although the configuration used is quite unorthodox, he found its performance to be most impressive in a number of ways.

When the editor advised me that the next review would be of an Australian-designed panel speaker system, my mind conjured up images of something akin to a 'Magnaplanar' or a 'Quad' electro-static speaker system, both of which I have previously reviewed, and both of which have set a standard against which all other panel speakers now appear to be judged.

The Lorpen Audio HP4 speakers duly arrived in my office in two relatively large and rather heavy packing cases, in lieu of the more conventional cardboard cartons which I thought had now become an industry standard. By that stage I already had my suspicions that the images which I had conjured up in my mind's eye may not have borne any similarity to the Lorpen Audio speakers which I was about to review, and as you may by now have guessed, I was right.

Whilst each of the speakers was reasonably well packed for the long journey from South Australia, and there were precise and well-written instructions on how to disassemble the packing cases, as I soon discovered, the packing had not been designed for multiple packing and unpacking. It was only then that I discovered that the Lorpen Audio HP4's were a pair of final 'pre-production' prototype speakers, rather than being a final pre-production version, as I might otherwise have anticipated.

With the first of the loudspeakers out of its box and with its neat grille removed, I was surprised to find that instead of the conventional electrostatic array I had half expected to find, I was looking at an array of eight Redford 170mm diameter woofers arranged in four vertical pairs on a gently sloping front panel face, which was open at the sides to produce a dipole sound source. These eight mid range speakers were supplemented by an unusual 28mm diameter Morel MDT 30 tweeter centrally located in the middle of the front panel, with a matching Morel MDT 30 tweeter high up on the back panel.



The appearance of the array was further confused by the presence of two strips of felt arranged in a cruciform with the tweeter at the centre, and with the felt deftly cut with little scalloped edges so that the outer edges of the tweeter were visually and acoustically screened.

The frontal array of eight Redford speakers have been designed to cover the mid range from 200Hz to 2kHz, and they are supplemented by a further four identical Redford woofers, each with its own 25-litre volume vented enclosure, which have been located immediately to the rear of the gently sloping front panel. The four woofers point out at an angle to one side, (presumably pointing towards the centre of the room), whilst the four matching ports point out towards the other side — which I have presumed were intended to point towards the outer walls of the room.

The appearance of this system was at variance to my expectations, and accordingly, rather than sit there sulking, I decided it was time to start asking some questions. It was only then that I discovered that the Lorpen Audio HP4's are the brainchild of Garth Pennington, who when not working on speaker development, is employed full time by Telecom as a Principal Technical Officer responsible for bringing old telephone exchanges into the 21st century — to match the demanding performance of their newer playmates in the field.

I soon learnt that the Lorpen Audio HP4's are the result of some three years of serious research and very patient ex-

perimentation, all of which was aimed at producing a speaker system whose size and appearance would be acceptable to Garth's wife. (Where have I heard those words before?) However, ignoring what I perceived to be Garth's primary design criterion, it also appears that he set himself a goal in which the acoustical characteristics of these new speakers had to be superior to those offered by other commercial systems — with whose performance Garth was apparently far from satisfied.

Garth's prior investigations had revealed that a dipole system appeared to offer superior acoustical directivity characteristics, and specifically in terms of those system's ability to satisfy the demanding spatial localisation requirements which he ranked as one of the most critical requirements. Garth also noted that the distortion characteristics of most conventional systems are primarily the result of the user's demands for high and ever higher sound pressure levels, which in turn result in the speakers being forced to work in a portion of their operating range where non-linear output characteristics generate ever higher, and all too often totally unacceptable distortion levels.

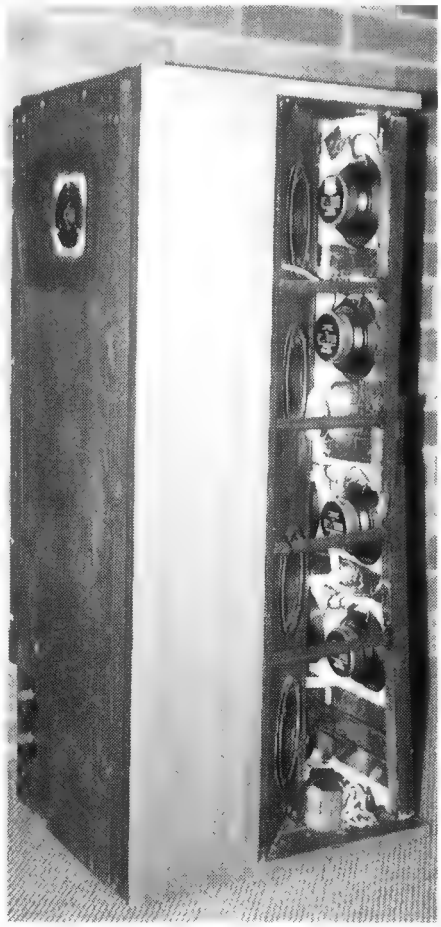
Garth's approach to this issue was that 'if you can't beat them, join them', and he adopted the obvious corollary that, if the load were to be shared between multiple drivers, so that each of those drivers was only operating at 1/4 or even 1/8th of the normal input power level, then that must result in a comparable reduction in the output distortion and a further overall reduction in the damage risk potential for those drivers as a result of overdriving them.

Garth also believes that there are significant acoustical advantages to be gained from a 'planar speaker' system, and his own prior exposure to electrostatic speakers with planar arrays convinced him that similar attributes could be achieved by replacing the electrostatic array with a planar array of conventional dynamic drivers with parallel input feeds. He decided that this concept and the design of the multiple low frequency ported enclosures could be further enhanced by a careful massaging of the Thiele/Small parameters, and a similar massaging of the porting details through the use of foam surrounds at their outlet faces, in order to obviate the potential for audible panting at the sharp entries at each of those ports.

That approach, as I soon discovered works extremely well, and the net result is he has ended up producing a loudspeaker system which quite frankly bears no physical similarity to any other speaker system that I have yet seen or tested.

Objective testing

I started by placing one of the pair of speakers into our anechoic chamber, to measure its frequency response by conventional techniques. As I soon discovered, the 'on axis' frequency response was far from flat, and exhibited a frequency response with pronounced notches at the crossover frequencies of 200Hz and 2kHz. The low frequency crossover notch



This side view of one of the prototype Lorpen HP4's gives a better idea of the rather unorthodox internal construction. Note the rear tweeter.

is quite explicable, and in these circumstances understandable, as when measured under anechoic conditions, it results from the acoustical screening provided by the front panel of the HP4 speaker system to the components close to the crossover which are screened from the measurement microphone.

By contrast, the depth and magnitude of the high frequency crossover notch is not so readily explained, and I measured it in three different ways to confirm its existence. My only explanation for this is that by adopting such a restrictive aperture in the felt cruciform for that tweeter, its output components close to the crossover frequency are possibly being screened in a totally unexpected way — and in these circumstances, one that is undesirable.

I repeated the near-field measurements at the side and rear of the speaker system, and as I soon discovered the 'off-axis' dipole characteristics rapidly compensate for the front panel's screening characteristics. But even so, they never completely compensate, and as a consequence there is a residual notch at 200Hz, irrespective of where or how you measure it.

This characteristic even shows up to a limited degree in the one-third-octave band room response recorded in my living room.

Whilst the 2kHz notch appears to be the result of interaction resulting from the two 100mm wide strips of 5mm thick felt which have been arranged in a neat vertical and horizontal cross, I still suspect that the novel star-cut aperture behind which the tweeter's face is located, may well be the culprit. Although this undoubtedly reduces the interaction between the tweeter and the mid-range drivers, it does so at the expense of a trifle more of the spectral output than may have been appreciated, in the vicinity of the crossover frequency.

Whilst the tweeter on the front panel is located at mid-panel point, by contrast the tweeter on the rear panel is located approximately 880mm above the floor, which of course places it in a different plane to the front panel tweeter. No reason is given for this asymmetric location, as the configuration no longer conforms to a conventional dipole. Although I detected no adverse impact as a result of the disparity of the two locations, I would be intrigued to know whether it was a result of experimentation or resulted from a theoretical analysis of the factors involved.

Although the Morel tweeters both use Ferro fluid damping, they are further protected by the introduction of a series of poly-switches, whose operating voltage levels may have been selected with a primary aim of protecting the tweeters from the ravages of high power and sinewave testing — which could quite reasonably have been expected during their review process. My measurements lead me to the conclusion that the poly-switch settings have been too conservatively selected, as at high input power levels, I became aware of a skewing of the frequency response, and a decided drop-off of the frequency components above 2kHz.

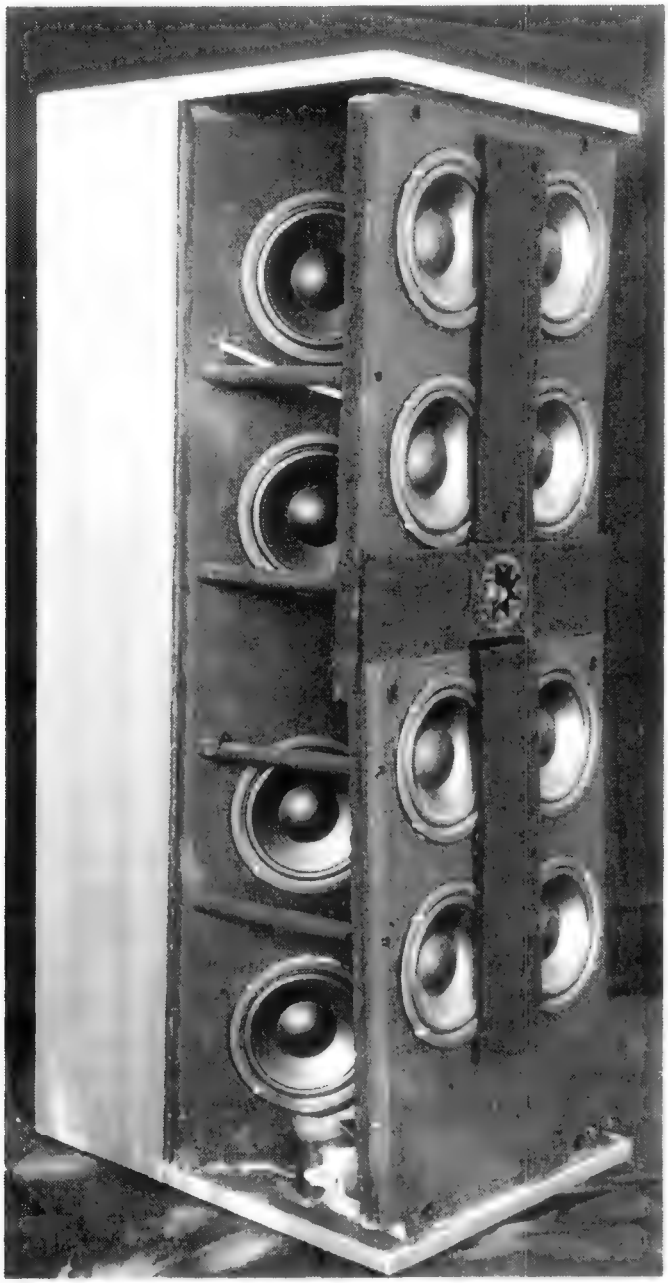
I was intrigued by the statements in the brochure that the output impedance is nominally 12 ohms, and ranges from five to 20 ohms. My impedance measurements revealed values as low as four ohms at 4kHz, with two highs of 24 ohms

at 70Hz and again at 1kHz. The International Electro-Technical Commission (IEC) recommends that input impedances should be specified on the basis of their lowest value, not their mean value, irrespective of what that value may be. Whilst the average may well be 12 ohms as the brochure suggests, it is very difficult to know where or how an average should be computed, or on what basis it should be averaged. The range of impedance values displayed are certainly adequate and/or appropriate for any conventional amplifier, and the low impedance at the top end of the spectrum should prove to be no problem for either the tweeters, nor for the driving amplifiers which may ultimately be used with these speakers.

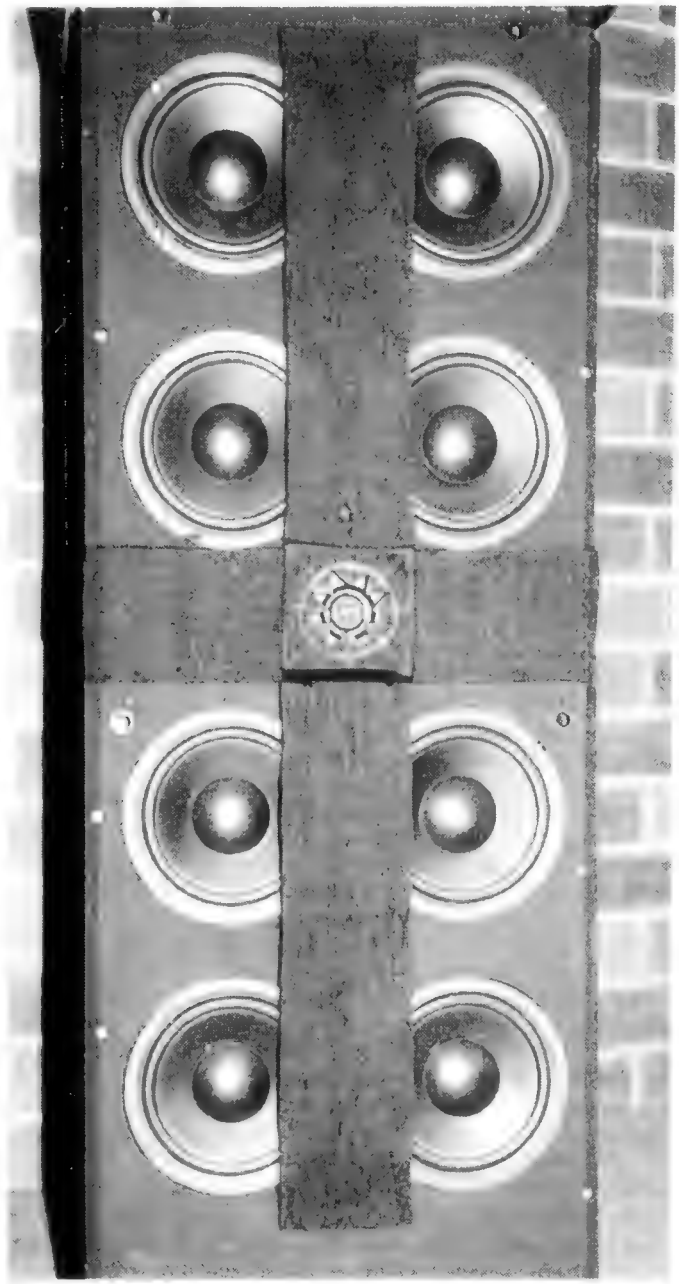
The phase response of the Lorpen Audio HP4's, when measured on axis at 2m, is particularly smooth, and these characteristics augured well for the subsequent subjective evaluation. The cumulative spectra decay at the top end of the speaker system is also relatively smooth, and indicative of a well selected tweeter configuration.

The one-third-octave band room response measured in my living room confirmed the same sort of details provided by my measurements recorded in our anechoic chamber — namely that the output balance is skewed slightly towards the bottom end of the spectrum, and that the speakers really do require the presence of a side wall typically within 1m of each of the cabinets in order to develop their full low end frequency response potential. The output sensitivity is typically 93dB at 1m on axis, for one watt input at 1kHz, and the speakers are reasonably efficient when compared with our vented enclosures and conventional dynamic speaker systems, against which I was able to directly compare them.

The most obvious objective attribute of



This photo shows the eight mid-range drivers and front tweeter on the front panel, and also the four woofers on the angled front face of the rear enclosures.



The front tweeter is positioned at the centre of a 'cross' of heavy acoustic damping felt, which as you can see partially overlaps the cones of the mid-range drivers.

the Lorpen Audio HP4 speaker system, is its reduction in the low frequency and mid frequency distortion, when compared with other comparable systems, and this is primarily the result of a division of the total radiated energy into multiple parallel driver units.

Subjective tests

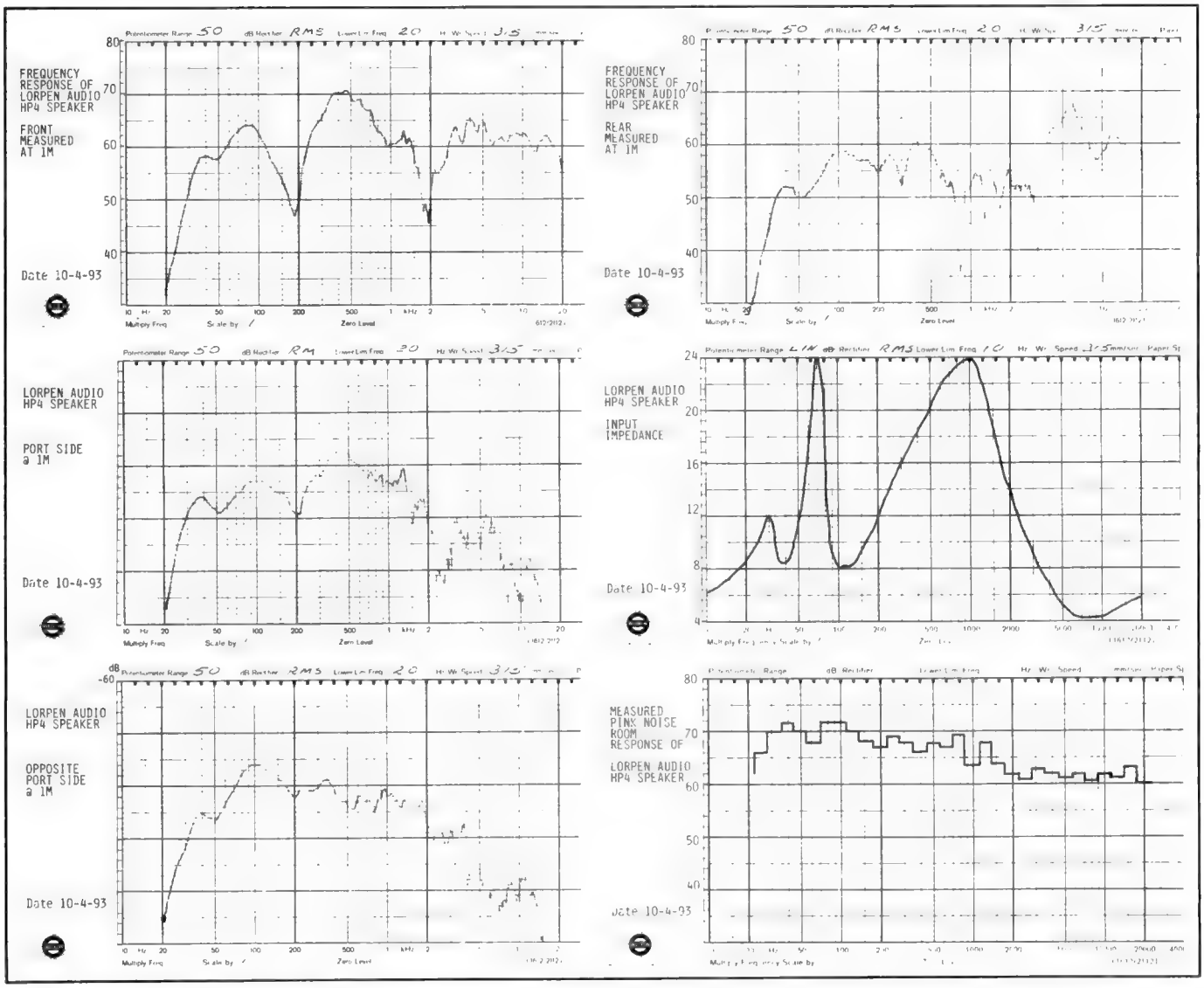
My subjective assessment of the Lorpen Audio HP4's, like my instrumental assessment, was regrettably restricted in time. But during the period available, I was able to assess the performance of the speaker system with some carefully selected software, demanding test signals, and a wide range of program content. Using this material I was able to monitor some very positive and as it happens, most impressive results from the Lorpen Audio HP4's — which although understandably promoted by their designer, had no other commendations to which they could lay claim.

I compared the HP4's directly against a pair of B&W 801M monitor speakers, which I believe still constitute one of the smoothest and most widely acclaimed speakers used for monitoring program content, and for direct comparison against other unknown speaker systems in assessments of this type.

Now this may appear to be a trifle unfair, as the B&W 801M's are (currently) nearly twice the price, and are the result of many thousands of hours of patient research work by one of the most highly respected speaker manufacturers in the world. It could be argued that such an approach in such circumstances may be a trifle unfair in the overall picture.

Although I had expected to find a gross and disparate difference in performance, I soon discovered that the differences were far less acute than I would have otherwise foreseen. More significantly, the differences that I did detect tended to be in different areas to those in which I would have expected to find them. Thus by way of example, on pink noise where the B&W 801M's really shine, the Lorpen HP4's displayed a detectable tonality at the bottom end of the spectrum, with an obvious gentle peaking in the output power somewhere in the frequency region below 200Hz. This audible tonality did not necessarily discourage me, and I progressed on to an evaluation of their spatial localisation characteristics.

Here for the first time the HP4's really shone. On the Chesky Records Audiophile Test Disc (JD37), with its 'Imaging Test LEDR and Acoustic Soundstage Test', they proved to have outstanding characteristics. In fact they provided an absolutely faultless display of sonic imag-



Six of the response plots for the Lorpen HP4 system, as taken by Louis Challis. On the left are the overall response plots taken from the front, port side and opposite port side, all at one metre. Then at upper right is the rear response, followed by the input impedance characteristic, and finally the pink noise room response.

ing, to the almost disbelief of some members of my test panel (quite apart from myself). We repeated the test, and convinced ourselves that these speakers really do have outstanding spatial localisation characteristics, and that the basic design concept has thus been well conceived, and more significantly is clearly effective.

We progressed to staccato tests using 'Different Strokes' from the Robert Hohner Percussion Ensemble (Digital Music Products Inc CD-485). Once again the reproduction of the original percussive sounds, as well as the general reproduction characteristics of the speakers was excellent, and I was impressed by the degree of realism which the speakers provided — within the central listening zone, which was located on the central axis between the angled speakers.

In order to evaluate the speakers' reproduction of human voice, I progressed to a new set of CDs which features Michael Lankester's version of Prokofiev's Oratorio *Ivan the Terrible*. On these two discs, Mstislav Rostropovich conducts the London Symphony Orchestra and Choir, whilst Christopher Plummer acts as the narrator (Sony Classical S2K 48 387).

As we soon discovered, Christopher Plummer's role as narrator is not only pivotal to the comprehension of both the historical, as well as the musical aspects of this Oratorio, but also provides a critical spoken voice component, which I regard as being an essential requirement in any loudspeaker evaluation.

Although I had not expected the Lorpen Audio HP4's to produce an excellent performance with the spoken voice, to my surprise they performed admirably, and even came close to matching the superlative performance of the B&W 801Ms. The HP4's also provided outstanding performance on the demanding choral component of the Oratorio, quite apart from providing an excellent reproduction of the musical instrument components on the discs.

For this particular set of discs the Lorpen Audio HP4's most certainly got a 'nine out of 10' from each of the members of my listening panel. The second of the two discs in the set also contained Prokofiev's *Alexander Nevsky*, which is an equally moving Cantata. I found it also to be an absolute gem, and again the Lorpen Audio HP4's performed very commendably.

Well pleased with that aspect of our assessment, we moved on to Bruckner *Symphonies Nos 8*, with Zubin Mehta conducting the Israel Philharmonic Orchestra. Although Bruckner's music is by no means as testing as Prokofiev's, the orchestral content provided an excellent means of assessing the HP4's performance, and with a more diverse range of instruments. Zubin Mehta and the orchestra once again provide a fine performance, and the speakers provided an equally fine reproduction — with outstanding stereo imaging and a reasonably good balance of the orchestra's sound reproduction characteristics, all the way down to at least 40Hz.

I took the opportunity to exercise the speakers' output to their maximum practical output potential, which was in the vicinity of approximately 108dB(A) at my seating position. At this level the onset of audible distortion started to become evident.

In the course of that exercise, however, I became aware of a drop in the tweeter's high frequency output, presumably as a result of the poly switches being activated. Whilst the selected mode of tweeter protection is clearly effective, it also has a tendency to be potentially disturbing, particularly where one expects the system to perform uniformly in terms of its frequency output with increasing input power level.

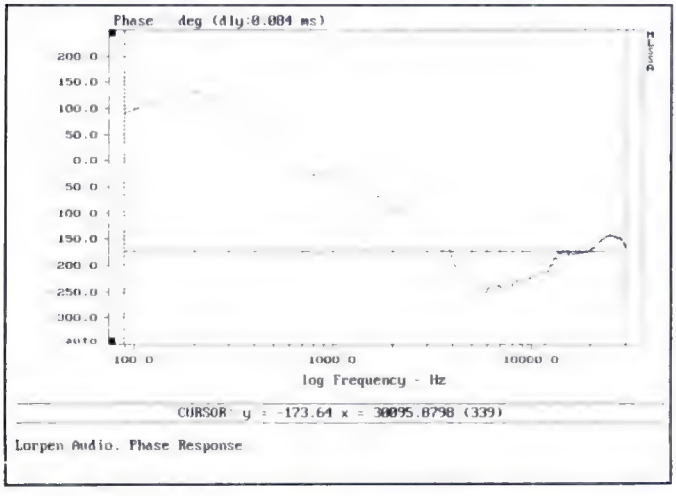
Even so, there are unlikely to be too many prospective owners who would wish to subject their ears — or their living rooms — to power levels as high as those which I adopted for that particular phase of my assessment!

Summary

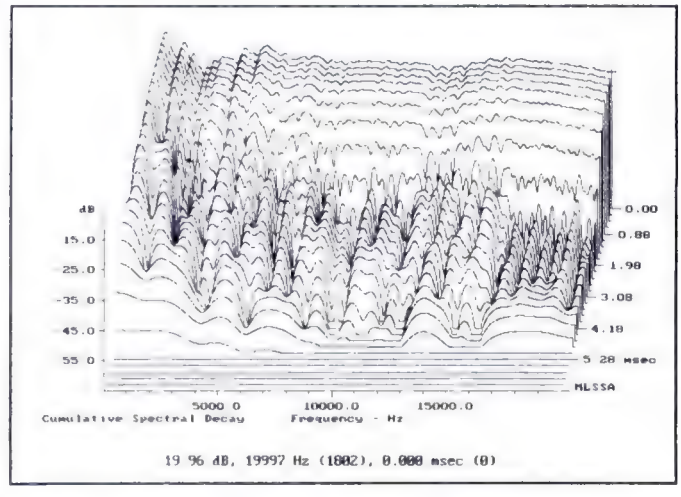
My overall impression of the Lorpen Audio HP4 speaker system is that Garth Pennington has achieved a very commendable result, from a speaker system which appears to have been initially designed to satisfy social and physical constraints originally imposed by his wife, as much as by himself. Although Garth may not have appreciated his wife's intervention in the decision making process, I suspect that many other husbands will, as her input has resulted in his satisfying a set of practical restraints to which many other husbands will ultimately need to similarly respond.

Whilst the Lorpen Audio HP4 Hybrid Panel speaker system which I have evaluated may only be a pre-production prototype, I have no reason to doubt that the production versions will be every bit as good, and possibly even better than the two-speaker system which I believe constitutes the most exciting recent development of speaker technology, in this country.

The dimensions of each HP4 enclosure are 1130mm (height) by 430mm (width) by 520mm (depth), and they each have a weight of 54kg. The recommended retail price of the HP4 system is $4500. Further information is available from Lorpen Audio, 11 Moldavia Walk, Osborne, Adelaide 5017; phone (08) 341 8201. ❖



The phase response for the Lorpen Audio HP4 system, measured on axis at a distance of two metres. As you can see, it is particularly smooth.



And here is the cumulative spectral response decay for the top end of the spectrum, which is again relatively smooth and indicative of a well selected tweeter configuration.

The Air Force is currently accepting applications from Year 12 students who want a degree in Engineering, Science or Arts from the Australian Defence Force Academy (ADFA).

However, to qualify you'll need to be in the top 30% of Year 12 students.

In fact, scholastic achievement alone isn't even enough. So before you consider doing your degree at ADFA, we'd like you to ask yourself a few questions.

Like, will you be aged over 17 and under 20 as at January 31st, 1994? Do you consider ADFA as one of your first choices to further your education? Is the opportunity to work with leading edge technology one of your priorities? Are you prepared to encounter demanding physical, military and leadership training on top of your tertiary studies?

If your response is an honest "Yes," then the Air Force can offer you a lot more than a challenging start to your career.

To begin with, you'll be paid to study. $12,216 in your first year, increasing to $18,324 in your third year. You'll also be involved in character building pursuits which simply aren't on the curriculum at other tertiary institutions.

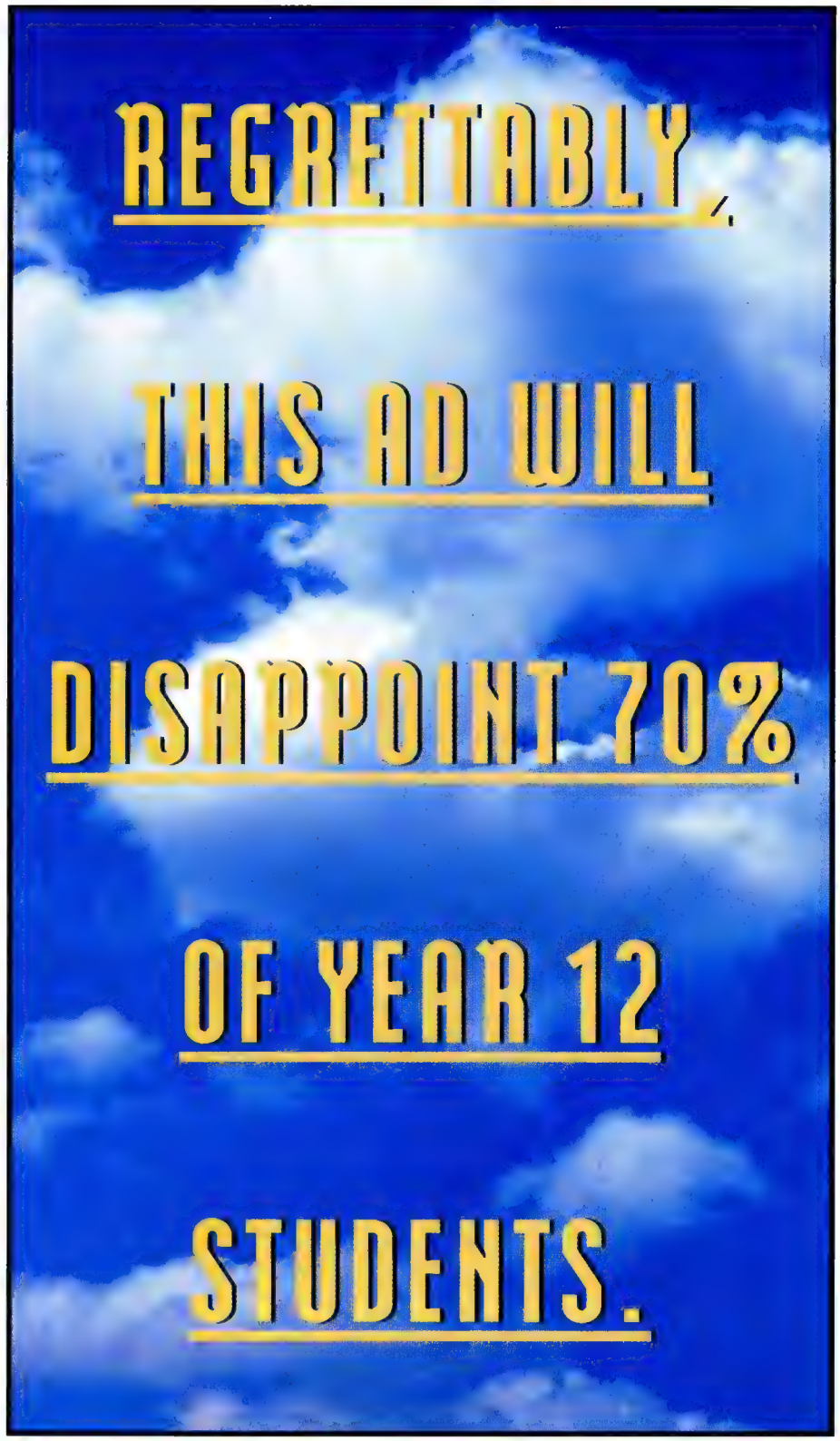
And you'll graduate from one of Australia's best Universities with a highly recognised degree, and the rank of an Air Force Officer in positions as diverse as Pilot, Electronics Engineer or even Air Defence Officer.

So if you're in the top 30% now, make sure you stay there. Get a better start to your career at ADFA, the University for leaders.

As there are a limited number of places, applications must close July 31st, 1993.

To find out more call your nearest Air Force Careers Adviser. Australia-wide 008 114 004, NQLD 008 015 150, NT 008 011 040. Or Melbourne (03) 639 1444. Sydney (02) 267 2773. Adelaide (08) 237 6222. Perth (09) 221 2424. Hobart (002) 34 7077. Brisbane (07) 226 2626. Canberra (06) 257 2311. Or send off the coupon for a free brochure.

ADFA AIR FORCE WAY TO GO



A BETTER START TO YOUR CAREER

Yes! I want to know more about a degree from ADFA and how to get a great start to my career. Please send me more information about: ❑ The Australian Defence Force Academy, and/or: ❑ $1000 scholarships for current Year 11 students.

Mr/Mrs/Ms/Miss: _____
First Name(s) Last Name

Postal Address: _____ Postcode _____

Telephone: ( ) _____ Country of Birth _____

I am an Australian Citizen or eligible to become one YES / NO. Date of birth: ___ / ___ / ____ I am medically fit: YES / NO.

Current or highest level of education achieved: _____

Subjects studied: ❑ English ❑ Maths ❑ Physics ❑ General Science ❑ Other: _____

Post to Air Force Careers Adviser, Reply Paid 2600AF, GPO Box XYZ (in your capital city). No stamp required.

FDL270593TA

Authorized by the Department of Defence RADFA1 FPC 43

READER INFO NO. 2

Space Communications Technology:

by Kate Doolan

NASA'S ORBITING SWITCHBOARD IN SPACE

One of the most unsung programs set up and operated by America's National Aeronautics and Space Administration (NASA) is one that is essential to the success of every space shuttle flight and Earth orbiting spacecraft. The Tracking and Data Relay Satellite (TDRS, pronounced 'Tee-Dress') system is a sophisticated network of five satellites that provide communications, telemetry, tracking, data acquisition and command services to a wide range of NASA programs.

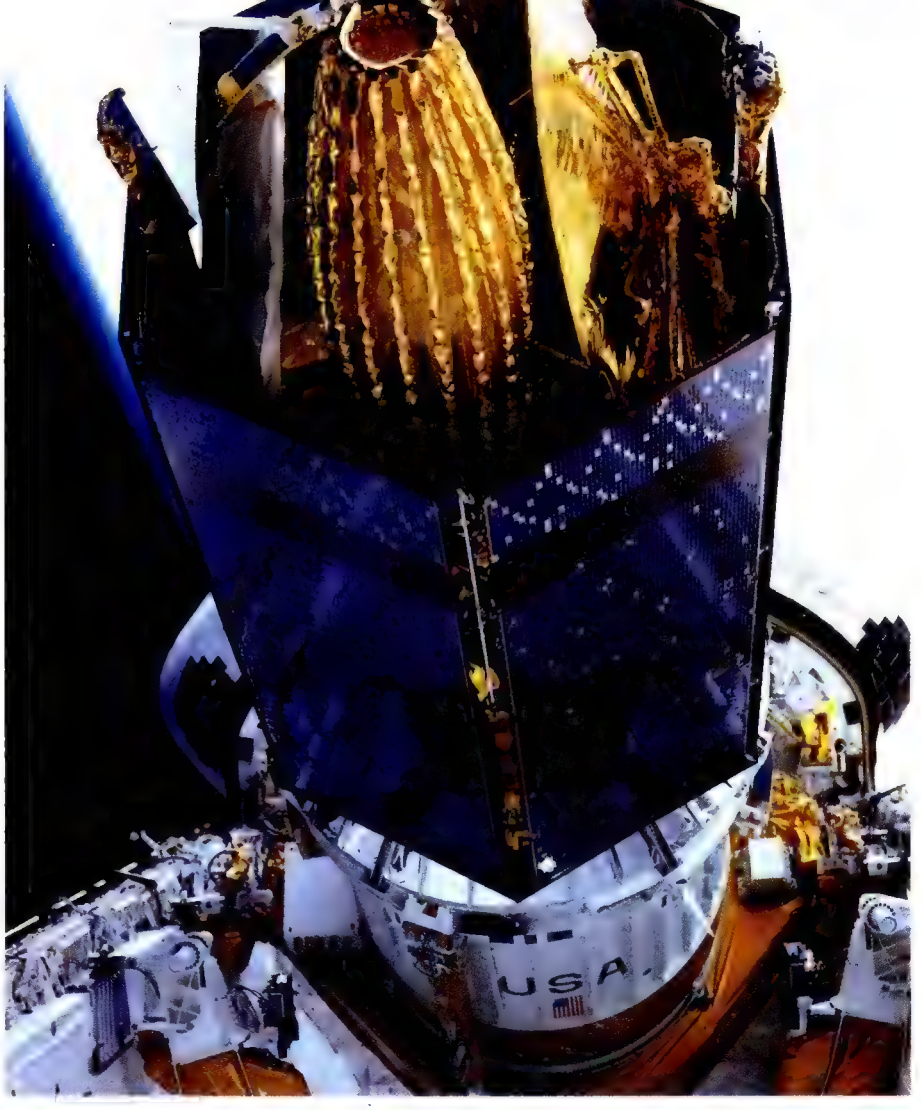
In 1964, the Goddard Space Flight Centre located in Greenbelt, Maryland requested staff at NASA Headquarters in Washington DC to consider the funding of an orbital tracking and data network which would support research technology tasks from an Earth orbiting spacecraft. Two years later, NASA HQ issued six-month contracts to the RCA Astro-Electronics Division and to the Lockheed Company to define the characteristics of an 'Orbiting Data Relay Network'. In 1967, NASA decided that this network would be essential for future space operations, and established a panel at Goddard to oversee plans for the network.

The general consensus called for a two-satellite network, with one spacecraft placed into a geosynchronous orbit about 130° over the equator near Brazil and the other southwest of Hawaii. It was hoped that this network would replace NASA's tracking and data network, which was a series of expensive ground stations and tracking ships situated all over the world.

Given the shrinking space budgets that NASA had to contend with in the early 1970's, NASA leaders realised that Congress would not grant them funds to develop the system and decided to consider leasing a satellite system from one of the space contractors. In addition to having two spacecraft in orbit, one would be kept in reserve for emergencies. NASA awarded the contract for the construction of six satellites to Western Union Space Communications.

Western Union began to build the satellites, but problems cropped up almost immediately. There were arguments on the issue of buying versus leasing the satellites, and also over how to launch the system. As well, massive inflation and cost over-runs were imposed by the Department of Defense, who wanted the satellites for their own use. Eventually, the TRW Space and Technology Group finished building the satellites and it was determined that the system be launched by the space shuttle — which at that time was scheduled to start flight operations in 1979.

Prior to the launch of the first Tracking and Data Relay Satellite, robot and manned spacecraft could communicate with Earth only when they were passing over one of NASA's ground stations, which were strategically placed on every continent and specially designed ships at sea. During the Mercury, Gemini, Apollo and Skylab programs, the combined communications time with the Earth station network averaged 20 minutes during each 90-minute orbit. In comparision,



Taken as the TDRS-6 was about to be released into space from the shuttle payload bay, this photo gives a very good view of the solar arrays folded around the antennas. Opposite: Our lead picture shows the TDRS-6 as it nears the end of construction at the TRW facility in Redondo Beach, California.

today's shuttle crews using the TDRS network are in communication with the ground constantly — even during the re-entry phase of the flight, which in early programs was impossible. Communications blackouts of up to 20 minutes were common during the re-entry of early missions.

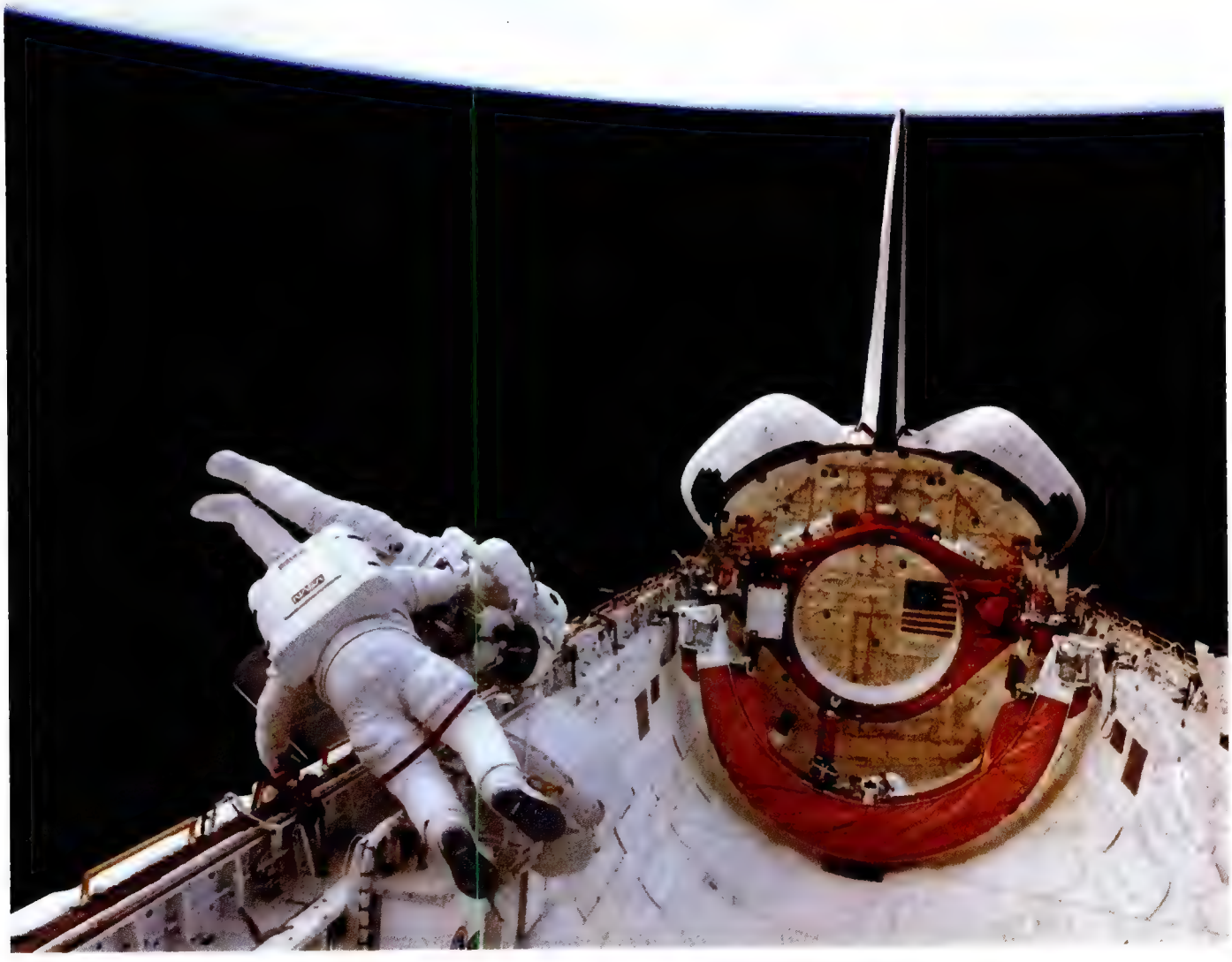
TRDS satellites

A Tracking and Data Relay Satellite measures 17.41 metres by 12.98 metres in length and weighs in at 2120 kilograms. The TDRS is a three-axis stabilised spacecraft that is composed of three modules: an equipment module, a communications payload module and an antenna module.

The spacecraft maintains attitude control through the gyroscopic action of body-fixed reaction wheels. Earth sensors provide the reference signal for controlling the wheel's speed in pointing the spacecraft towards Earth. Precision mechanical gimbal drives point the two deployable antennas and the space-to-ground link antenna, in response to ground commands. Reaction wheel speeds change almost constantly as the Earth sensor responds to minute disturbances produced by the Earth's magnetic field, solar pressure and antenna motion.

When the wheel speeds become too high or low, monopropellant hydrazine thrusters are fired to control the attitude of the spacecraft, while the wheel speeds are brought within their desired operating range. These manoeuvres, known as 'momentum dumps', are performed on two- to seven-day intervals thoroughout the 10 year design life of the spacecraft. Some 3300 kilograms of propellant are provided on each TRDS satellite for these manoeuvres.

A TDRS satellite is powered by two solar panels, which measure 4.1 metres in length and width. These panels have 28,000 solar cells which provide 1700 watts of electrical power over the life of the satellite. Three 40-ampere-hour nick-



Astronaut Gregory J. Harbaugh (red stripe on suit) carries astronaut Mario Runco Jr. along the starboard side of Endeavour's cargo bay during the four-hour plus extravehicular activity (EVA) on January 17. This portion of the spacewalk was to evaluate the ability of an astronaut to move about in space with a 'bulky' object in hand.

el cadmium batteries supply power to the spacecraft when it is out of reach of the Sun.

The 'payload' module of a TDRS satellite consists of the electronic equipment required to provide communications between the user spacecraft and the ground. Receivers and transmitters for single access services are mounted into compartments on the back of the spacecraft.

'Antenna farm'

Each satellite has been described as an 'antenna farm', as they have seven antennas — including a 30-element phased array. TDRS are the first communications satellites with a simultaneous three-band frequency service capability, operating on the S band (2-4GHz), C band (4-8GHz) and high-data-rate Ku band (12-18GHz).

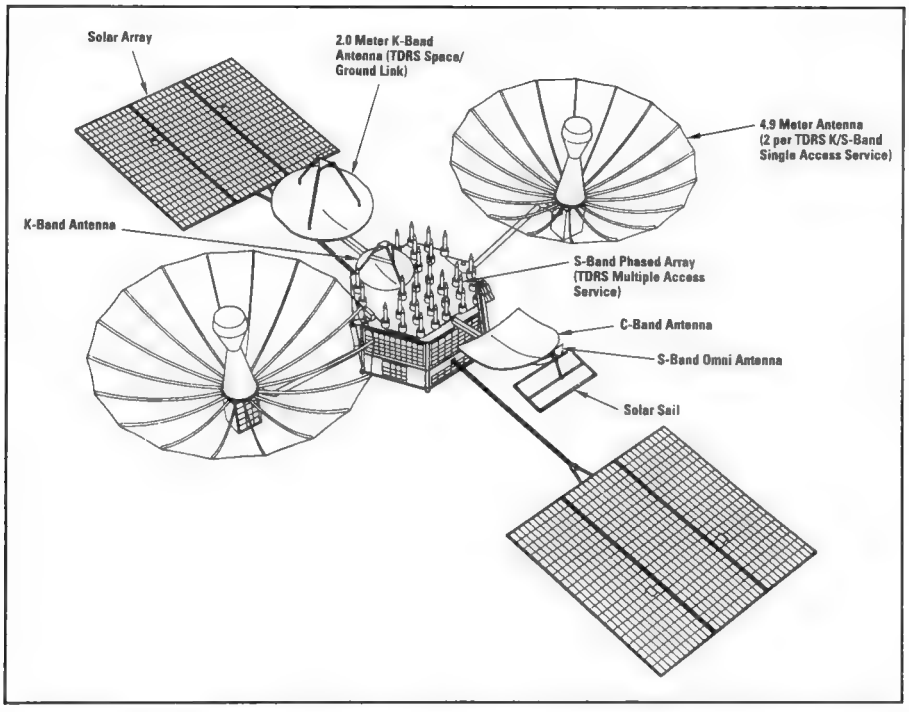
The spacecraft has two main antennas that are deployed once the satellite arrives in orbit. These antenna each measure 4.9 metres in diameter and when fully deployed the pair measure 13 metres from edge to edge. The surface of each antenna is covered by a 24-carat gold molybdenum wire mesh. When deployed, 18.9 metres of mesh are stretched between 16 supporting tubular ribs, by fine thread-like cords. The whole antenna structure only weighs 24.3 kilograms and is the same design as the Galileo spacecraft's ill fated antenna.

Fully deployed, each antenna provides S-band and Ku-band frequencies. The high-data-rate service made possible by the antennas are available to users on a time shared basis. Each antenna has the versatility to simultaneously support two user spacecraft — one on the S-band and one on the Ku-band, when both users are co-located in the antenna beamwidth, or a single user such as the space shuttle which can operate on both bands simultaneously.

A third antenna which is used for multiple-access services is a 30-element, S-band phased array of helical radiators, which are mounted on the spacecraft's body. All 30 of the antenna elements are used for the multiple-access return services, which receive signals from users. Twelve of the 30 elements are also used for multiple-access forward services, to transmit signals to users.

Multiple-access return links from the 30 array elements are sent separately to the main TDRS control centre located at White Sands in New Mexico, where they are combined electronically into 20 beam-forming networks. In this way, the multiple access return link uses all 30 of the elements to electronically form beams which are pointed at up to 20 user satellites.

A fourth antenna, the Space/Ground Link antenna, transmits all of the signals received by the other three antennas to the TDRS Control Centre for processing.



This diagram shows the TDRS-6 satellite when all of its antennas and solar arrays are fully deployed. Note the considerable number of antennas — including the S-band phased array on the body of the satellite itself.

This antenna also receives signals from White Sands for retransmission to user satellites via other antennas. The fifth antenna is a S-band omni type which provides near spherical coverage for the launch and emergency operations, allowing command and telemetry when the spacecraft is not orientated towards Earth. Two additional antennas are provided for commercial communications channels.

Ground complex

The TDRS ground station network at White Sands is one of the largest and most complex tracking facilities ever built. The White Sands Ground Terminal includes three 18-metre Ku band dishes, a six-metre S band dish, several smaller Ku and S band antennas, user communications and a multiprocessor network.

The eleven-computer data network plays a large role in system operation. It aids in making user satellite tracking measurements, the steering of all satellite antennas and control of all equipment on the satellites and at TDRS ground stations. This computer network and its associated software requires approximately 1.5 million machine language instructions, resident in the 11 computers. The control functions are performed automatically, in response to automated requests for user services.

Requests will reach the ground station from NASA via a computer to computer link. From the receipt of a user service request to the final delivery of the data to the user, no human intervention is required.

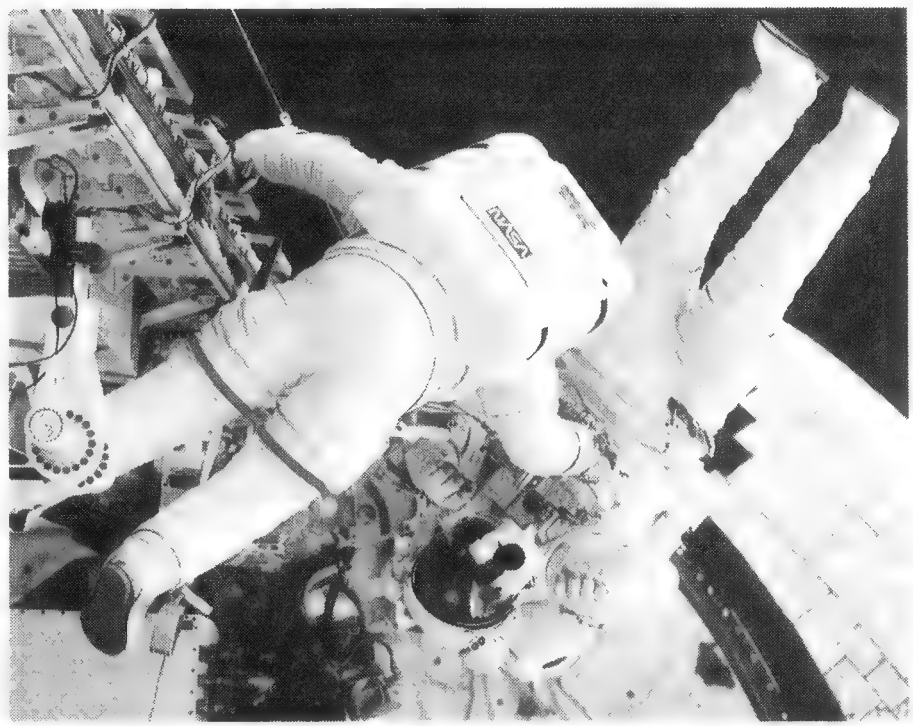
To simplify the satellite design, the ground station performs many command and control functions which could have been performed by the satellite itself. An example of that is error signals that are used in the tracking of user satellites by the spacecraft antennas.

These signals are developed remotely on the ground and antenna positioning commands are sent to the spacecraft to close the tracking loop. All the user satellite telemetry generated is relayed by TDRS through the White Sands Ground Terminal. NASA then sends the data to its field centres such as the Goddard Space Flight Centre — or when a shuttle mission is taking place, the Johnson Space Centre in Houston, Texas.

Shuttle, then IUS

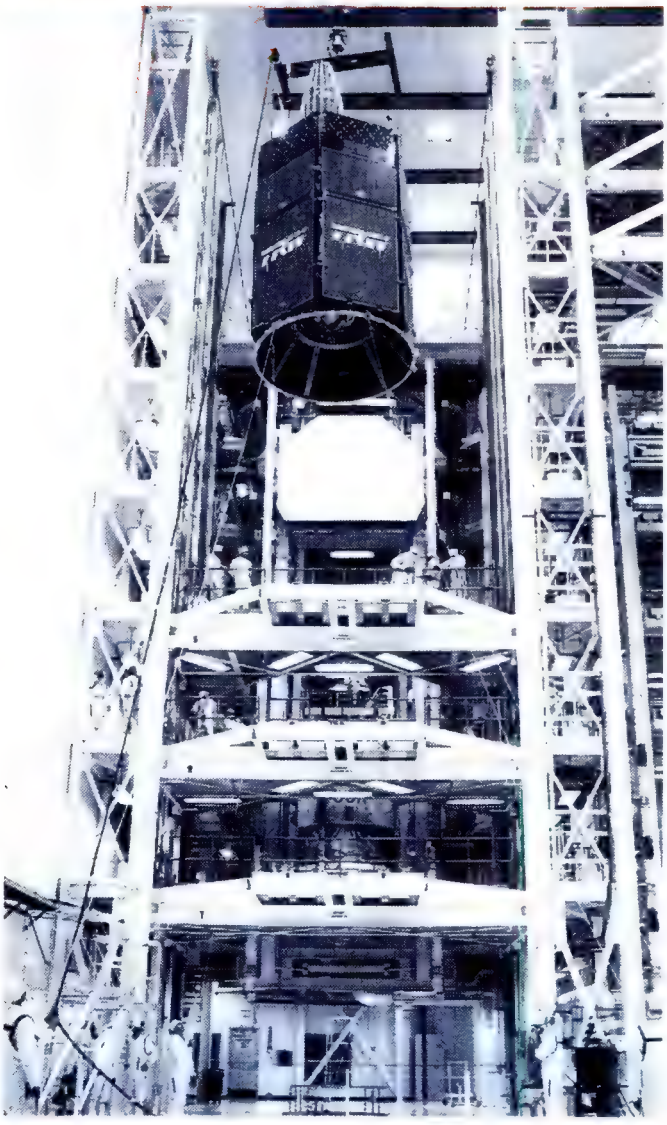
TDRS satellites have been designed for exclusive launch by the space shuttle. After the shuttle launches, the TDRS is propelled into an initial low Earth orbit of 352 kilometres. Then to get the satellite into its permanent geo- synchronous orbit of 35,880 kilometres an Inertial Upper Stage (IUS) is used.

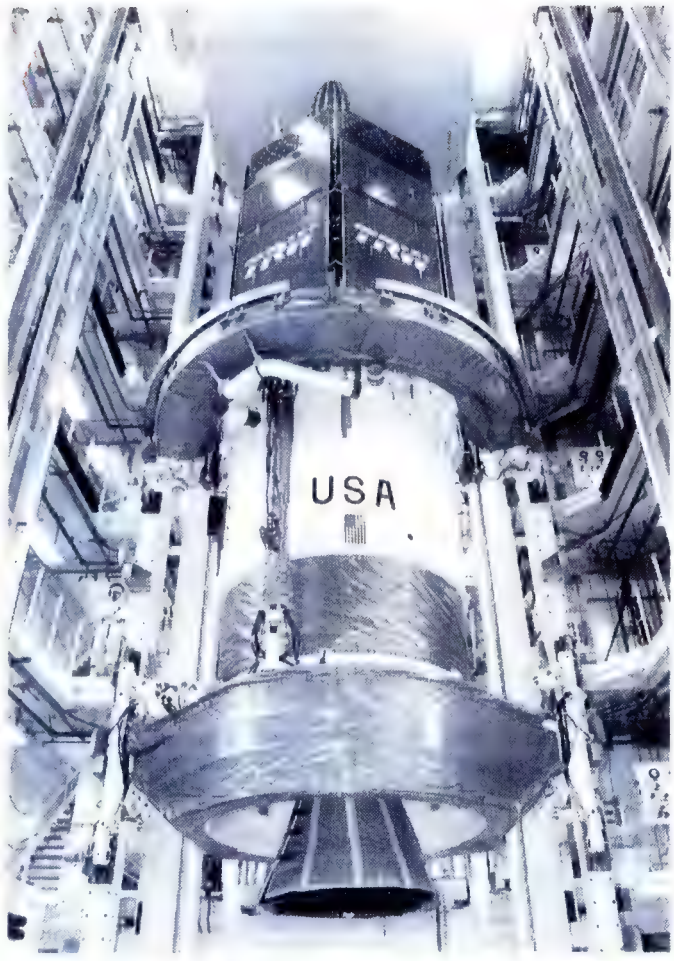
The IUS is a two-stage rocket developed by the United States Air Force and built by the Boeing Aerospace Company. It measures 5.18 metres in length and is 2.18 metres in diameter. The main components are an aft skirt, an interstage and an aft stage solid rocket motor which contains 9707 kilograms of propellant and generates 188,496 newtons of thrust. A forward stage solid rocket motor weighing 2722 kilograms provides a fur-



Another view of Astronaut Harbaugh carrying Mario Runco, during the EVA exercise on January 17. Note the ceramic heat insulating tiles on the rocket faring visible in the lower right hand corner.

NASA's Orbiting Switchboard





Above: The combined TDRS-6 satellite and its Inertial Upper Stage (IUS) are shown here being transferred into the Shuttle payload canister, before moving to the shuttle proper.

Left: The TDRS-4 satellite is hoisted aloft in the vertical processing facility at Kennedy Space Center, for mating with the IUS-9. The latter is just visible in the test cell, behind the first level landing stage.

ther 80,784 newtons of thrust, and there is a section for support equipment.

The equipment support section contains flight avionics which provide guidance, telemetry, control, navigation, reaction control, electrical power plus command and data management systems.

The IUS has a number of advanced features that were not present in earlier upper stages. The avionics system has redundancy, so in-flight equipment failures can be diagnosed and repaired in milliseconds. Also provided are a redundant computer system and an advanced carbon-composite nozzle throat which can make long duration firings of the motors possible.

First up

The first TDRS satellite, TDRS A was launched aboard the space shuttle *Challenger* by the crew of STS-6 in April 1983. Difficulties arose after deployment of the satellite, when an oil filled seal on the IUS second stage deflated — crippling the steering mechanisms of the satellite. The satellite then went into a 30-rpm spin and it was only quick action by the ground controllers that saved it.

The IUS was separated from the satellite and stabilised into an orbit of 29,000 kilometres. Over the next eight weeks, the ground team using the small manoeuvring thrusters of the satellite were able to move it to its permanent geosynchronous location of 171° West longitude. Following the IUS failure, the space shuttle launch schedule was thrown into chaos. STS-8, which was to carry the second TDRS satellite was cancelled — as was STS-10, the first classified military flight. The IUS control system was thoroughly investigated and as a result another TDRS flight was not scheduled to launch for nearly three years.

TDRS B was aboard mission STS-51L, when the space shuttle *Challenger* exploded 73 seconds into its flight on 28 January 1986. After a hiatus of 32 months, the space shuttle flew again on 29 September 1988. The crew of STS-26 successfully deployed the TDRS C satellite six hours into the flight. TDRS C, renamed TDRS 3, is now located at 62° West longitude over Brazil.

In March 1989, TDRS D christened TDRS 4 was deployed by the crew of STS-29 and it is now located at 41° West over the Atlantic Ocean.

Following the TDRS 4 deployment, several of the NASA Earth stations were closed down as the TDRS system was operational and had taken over many of the functions of those stations. Another TDRS satellite was launched by the crew of STS-43 in August 1991; TDRS E, now TDRS 5, resides at 174° West longitude.

Latest launch

The most recent launch of a TDRS satellite occurred earlier this year. The

crew of STS-53, aboard the space shuttle *Endeavour*, were launched from the Kennedy Space Centre in Florida on 13 January 1993. The crew was commanded by John Casper, pilot Don McMonagle with Mission Specialists Mario Runco, Greg Harbaugh and Sue Helms. All except Helms had travelled in space previously.

Six hours into the flight, Mario Runco deployed TDRS F, which is now known as TDRS 6 and lives at 62° West longitude as a backup satellite. The remainder of the flight was devoted to experiments of all varieties, the most interesting being when the crew took their favourite toys into space to demonstrate scientific principles for schoolchildren. Also on board was a controversial new toilet system, which had raised the ire of US government auditors as it cost some US$23 million to develop — and true to form suffered a breakdown during the flight!

On the fourth day of the flight, astronauts Harbaugh and Runco completed a 4-1/2 hour spacewalk, demonstrating construction techniques for Space Station Freedom — which is scheduled for launch in the later part of the decade (although this is currently back in the melting pot). After a flight of six days, *Endeavour* landed at the Kennedy Space Centre on 19th January.

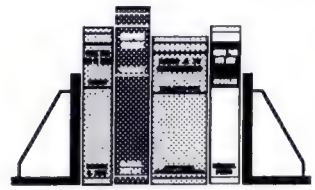
After TDRS 6 arrived 'on station', a reconfiguration of the TDRS system took place. Due to a failure in the flight recorders of the Gamma Ray Observatory (GRO), NASA decided to use one of the TDRS satellites exclusively to receive real-time data from GRO. A remote tracking station was built at the Deep Space Network at Tidbinbilla, in the Australian Capital Territory, and TDRS A was shifted to 85° East for this purpose.

Currently the eighth TDRS satellite is under construction at the TRW facility in Redondo Beach, in California, and will be launched by the space shuttle in 1995.

At present there are plans for a new TDRS system, and it is expected that this will be built and launched in the late nineties. For the time being though, the existing TDRS system is up, operating and sending back mountains of data from each flight — which before the advent of the space shuttle would have been impossible.

In closing the author would like to thank Jim Elliott, of the Goddard Space Flight Centre, and Kay Grinter of the Kennedy Space Centre for their assistance in the completion of this article. The photographs reproduced are by courtesy of TRW and Media Services, Johnson Space Centre. ❖

NEW BOOKS



Experimenter's guide

THE ART OF SCIENCE, by Joseph J. Carr. Published by HighText, 1992. Soft cover, 230 x 154mm, 365 pages. ISBN 1- 878707-05-1. Recommended retail price $34.95 (students, $29.95).

The author wrote this book because he believes that there is a tremendous lack of understanding of how the research *process* works, and a general misunderstanding of how to process experimental data . Aimed at students from senior high school to graduate school, the book shows how to do good experimentation, and how to avoid pitfalls.

The 15 chapters explain what science is about, and how to think scientifically. They cover the basic mathematics needed 'to do science right', explaining simple terms like 'average' as well as more complex ones like 'regression analysis'. Also covered is how to keep records, and how to use (and abuse!) graphs to present your data effectively.

The first of three appendices is called 'Counterfeits of Truth' — 26 different ways (which unfortunately are often encountered) to draw *illogical* conclusions from your data. These provide a very interesting way to explain how *not* to argue critically! The other two appendices are MS-DOS computer programs, one to perform common statistical computation, and the other to generate data to be analysed scientifically.

I found the book to be extremely readable and interesting. All concepts are well explained, with plenty of worked examples and illustrations. Even though the book is primarily meant to introduce the lay person to the world of science, it could serve equally well as a source of ideas for an educator.

The review copy came from Dick Smith Electronics, who list it as cat. number B 1300. It is available from all DSE stores. (P.M.)

Guide to Shortwave

SHORTWAVE LISTENING GUIDEBOOK, by Harry H. Helms. Published by HighText Publications, 1991. Soft cover, 228 x 152mm, 316 pages. ISBN 1-878707-02-7. Recommended retail price $29.95.

An easy to read introduction to the world of shortwave listening, written primarily for those who are 'starting from scratch' without any prior knowledge. The author explains in his preface that as a youngster, he found listening on shortwave opened up a whole new awareness of the world's peoples and cultures — and his aim here has been to help today's young people achieve the same satisfaction and benefits.

In the book he covers virtually everything you'd need to get going on shortwave: the basics of radio and propagation, selecting the right receiver and antenna, and of course a lot of basic information on the international bands and broadcasters. There's even handy reference data like world callsign allocations, the international phonetic alphabet, the Q code and a listing of standard time and frequency stations (but not Australia's own VNG, sad to say).

Just about all of the information given is just as applicable to the Australian as to the US shortwave listening scene. In fact the book would make an excellent choice for anyone wanting to break into shortwave listening.

The review copy came from Dick Smith Electronics, and is apparently exclusive to DSE in this country. Listed as cat. number B 2040, you should find it in any of their stores. (J.R.)

Practical circuits

ELECTRONIC CIRCUITS HANDBOOK, Second edition, by Michael Tooley. Published by Butterworth-Heinemann, 1993. Soft cover, 245 x 190mm, 373 pages. ISBN 0-750640750-5. Recommended retail price $69.95.

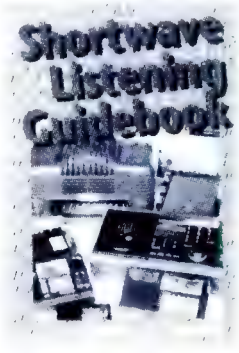
This book aims specifically to provide the reader with a collection of practical working circuits plus supporting information, so that circuits can be produced without recourse to theoretical texts. That reader can be an electronics engineer, technician, student, or just an enthusiast. The author only assumes an elementary understanding of electrical principles, and a familiarity with common electrical units and quantities.

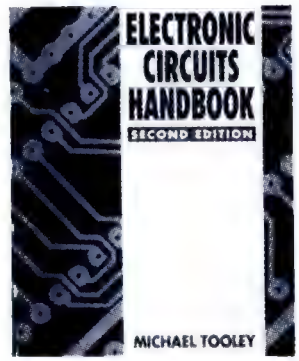
The 15 chapters cover a wide range of topics: from passive components and transistors to computer interfacing. There are circuits for all common electronic applications: power supplies, amplifiers and op-amps, logic, timers, power control, optoelectronics, and radio frequency reception and transmission. Hints for circuit construction are also given, along with 10 projects to build several items of test equipment. Some useful BASIC programs are included in the Computer Aided Design chapter.

Six appendices give further information like component symbols, transistor mounting details and pin connections.

This is an extremely useful book, which gives ready access to many circuits which have been built and tested. Many texts give circuits as illustrations of the theory being explained, which are not really meant to give you practical circuits. Not so this book, which emphasises its practical applications.

The review copy came from Butterworth-Heinemann, 271 Lane Cove Road, North Ryde 2113. It should be available from technical bookshops. (P.M.) ❖





You're zooming up a single shot 10 ns spike, an event you simply cannot see on any low cost digital scope. Unless it's the new TDS 320 with its incredible over sampling. Truly the world's first affordable 100MHz digital real-time scope.

At 500 Megasamples/sec our new 100 MHz TDS 320 combines the storage and data manipulation benefits of digital storage with the signal fidelity of real time. So you can make precise, confident measurements quickly.

The intuitive TDS user interface means more time using and less time learning. And finally the low price tag is yet another spike that the competition can't catch.

Call Tektronix today on 008 023342 and get your hands on the best value scope available.

Tektronix

READER INFO NO. 4

KEEPING AUSTRALIANS IN TUNE & ON TIME...

Many of the larger countries maintain standard frequency and time signal broadcasting stations, to provide people who are spread over a wide area with a convenient reference to signals derived from the country's primary standards. Australia's own time and frequency station VNG is now securely back in operation, after passing through a somewhat rocky period in the recent past.

In September 1964, Telecom's predecessor the PMG's Department began transmitting 'experimental' frequency and time standard transmissions from Lyndhurst, Victoria. The station acquired the callsign 'VNG', and soon became relied upon as a source of time reference signals. STC transmitters with an output of 10kW were used, feeding signals to half-wave folded dipoles on 4.5, 7.5 and 12MHz. The time signals carried were derived from equipment attached to the speaking clock at Melbourne's City West exchange, relayed to Lyndhurst via 30km of program line.

A little over five years later, in December 1969, both the time signals and the stability of their carrier frequencies were improved considerably, making VNG of even greater value. Lyndhurst's quartz crystal frequency standard was locked to the PMG's caesium-beam atomic primary standard via a low frequency control signal, again fed via landline from Melbourne (later Clayton), and a more complex time signal provided increased time-of-day information.

For the ensuing 18-odd years, the signals from VNG were widely used and 'taken for granted' around Australia by a broad spectrum of people working in many fields, as a time and frequency reference. However this era in the station's history came to an end in 1987, because the Australian Government had decided to sell the Lyndhurst site and Telecom no longer needed the station's signals for its own purposes.

Telecom offered to give the VNG equipment free of charge to any organisation willing to run it, but warned that the running costs were around $144,000 per year. It also warned that the transmitters were about 20 years old, and would soon need replacement — at an estimated cost of $1 million.

Despite the number of organisations and individuals who made use of the station's signals, there were no volunteers. As a result the station was closed down on October 1, 1987.

The VNG transmitter hall at Llandilo, with the 16MHz transmitter on the left and the three 10kW transmitters on the right. (Photo courtesy of Dr M Leiba).

User meeting

When VNG ceased operation, however, it didn't take long for users to realise just how important it was to have such a source of 'medium accuracy' (i.e., within a millisecond) time signals. On December 1, 1987 a meeting of former VNG users and 'other interested parties' was called by the National Standards Commission, to decide what action should be taken — if any.

Nearly 100 people attended the meeting, and passed a resolution that the NSC's Precise Time Working Group should investigate ways of resurrecting VNG. The Precise Time Working Group consisted of Dr John Luck from the Orroral Geodetic Observatory, Dr Grahame Harvey of the NSC, Mr Ian Harvey of CSIRO's National Measurement Laboratory and Mr Rob Harris of Telecom Research Laboratories (who was also previously in charge of VNG).

During the following two and a half months, the PTW Group identified a possible site for VNG's rebirth at the CAA's international transmitting centre in Llandilo, northwest of Sydney. It also obtained Telecom's agreement to donate the VNG equipment to the NSC.

Consortium formed

By mid-February 1988, it was apparent that the VNG equipment would have to be removed from Lyndhurst urgently, if it was going to be saved for any revival. The site was being prepared for sale, and although Telecom was supplying the equipment to the NSC free of charge, it wanted $4500 to cover the dismantling and packing up.

There was insufficient time to ar-

range Government funding, and VNG's users would have to be asked to contribute. Because it wasn't considered appropriate for a Government body like the NSC to solicit donations, those concerned decided to form a VNG Users Consortium.

The Consortium's committee consisted of Dr John Luck, Ian Harvey, Dr Gary Hovey of the Mt Stromlo Observatory, David Herald of the Canberra Astronomical Society, Gary Gibson of the Seismology Research Centre of Phillip Institute of Technology, and earthquake seismologist Dr Marion Leiba — who became its Honorary Secretary and publicist.

The inaugural meeting of the VNG Users Consortium took place on February 25, 1988, and the committee set its objective: to re-establish and maintain a national HF standard frequency and time service. It was also agreed that they would prepare and mail a letter to all known VNG users, requesting contributions to cover the cost of acquiring the equipment from Lyndhurst, and running the station when it was resurrected.

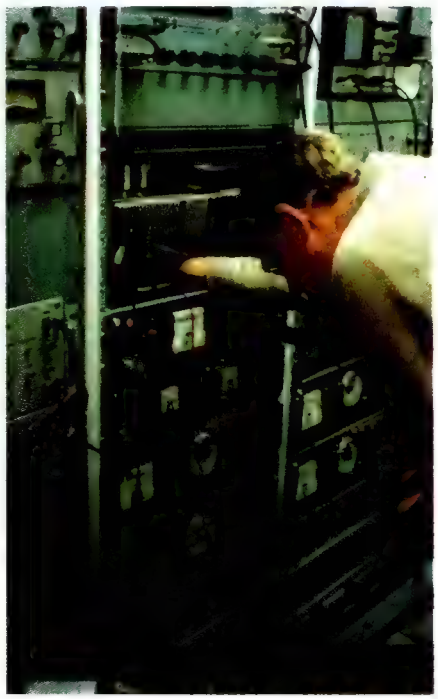
Dr Leiba reported that the response from VNG users and sympathisers was 'heartwarming'. Even private individuals contributed from their own pockets figures of up to $100, to save this valued national facility. One contributor, a short-wave listener who was unemployed at the time, sent a contribution because he felt so strongly that Australia should continue to have its own standard frequency and time service.

Organisations, even quite small ones, also gave the Consortium donations — some as high as $2000. One small firm gave not only $500 for acquisition of the equipment, but also pledged a further $200 towards the running costs. It was not until they finally heard the first time pips and voice announcements from the revived VNG, says Dr Leiba, that they admitted they'd first thought the project to be impossible!

By late 1989, Dr Leiba reported that over $10,000 had been donated by some 60 users and sympathisers, including amateur astronomers and astronomical societies. This had enabled the Consortium to pay for both the dismantling and packing of the equipment, and also its transporting from Lyndhurst to Llandilo.

Llandilo is located near Penrith, at latitude South 33° 42' 52", and longitude East 150° 47' 33". The bulk of the VNG equipment was moved from Lyndhurst by commercial carrier on June 16-17 1988, with the timing equipment and four transmitters occupying a complete large semi-trailer. The remainder — 14 large capacitors — was transported to the new site by a 'relay' of two pairs of VNG users, two weeks later in a private vehicle. The transmitters were so large that the doorway of Llandilo's transmitter hall had to be enlarged to admit them.

The cost of setting up the equipment at Llandilo was paid by AUSLIG, the Australian Surveying and Land Information Group of the Department of Administrative Services. The VNG Users Consortium was able to partially reimburse AUSLIG for these costs, from the balance of its donated funds. AUSLIG initially held the new VNG station licence, and began funding the operational and licence expenses with continuing help from the Consortium. Responsibility for operating the VNG transmitters at Llandilo had been accepted by CAA staff.



VNG contributor Vagn Jensen installing the frequency synthesisers he designed and built for the 8.638 and 12.984 MHz transmitters. (Photo courtesy Dr M Leiba).

Restored to life!

After some very hard work, the first test transmission from the newly-restored VNG took place on August 11, 1988 — less than a year after Lyndhurst had been switched off.

The transmission was on 4.5MHz, with a power level of 2.5kW. A second test took place the next day, with full power of 10kW. These transmissions were purely for equipment testing, and carried no time signals.

On August 17, staff from the Telecom Research Laboratories and National Measurement Laboratory installed and set up a rubidium standard, to provide the new VNG with time signals. The voice announcing cartridges were inserted for the first time in 10 months, and VNG's pips and UTC (Co-ordinated Universal Time) time announcements were again heard throughout much of the land. Members of the VNG Users Consortium, present for the re-commissioning ceremony, celebrated with the traditional glass of champagne...

Their celebrations were to be short lived, however. No sooner had the voice announcements been restored than complaints started to come in, from spectrum users in the Sydney area with allocations near 4.5MHz. The new VNG appeared to be causing interference, and the Radio Frequency Licensing Branch of the Department of Transport and Communications (DOTC) ordered that the station be switched off until the problem was sorted out.

On September 21, 1988, VNG's Precise Time Working Group and Llandilo operators met with the DOTC RF Licensing Branch. In addition to discussing the interference problems, it was pointed out that the station's old working frequencies of 4.5, 7.5 and 12.0MHz were outside the bands allocated to standard frequency and time signal services in the Australian Radio Frequency Spectrum.

DOTC wanted to allocate VNG new frequencies of 5.0, 10.0 and 15.0MHz, which are in the bands officially designated for this type of service. However the same frequencies are also used by many of the time and frequency stations overseas, including those of the USA. The Consortium realised that this would not be an ideal long-term solution, but decided to accept these frequencies as an interim measure.

There were various delays to obtaining the licences for the new frequencies, and the station was silent for many weeks apart from short transmissions on 4.5MHz in October and on 5.0MHz in November. Eventually a three-month temporary licence for 5.0MHz was granted on December 8, 1988, and in due course this was extended by the same period three times.

The transmitting antenna used initially was of the omnidirectional vertical type, but people living around Llandilo complained that VNG was interfering with their VCRs. Although DOTC investigated and advised that the 5.0MHz

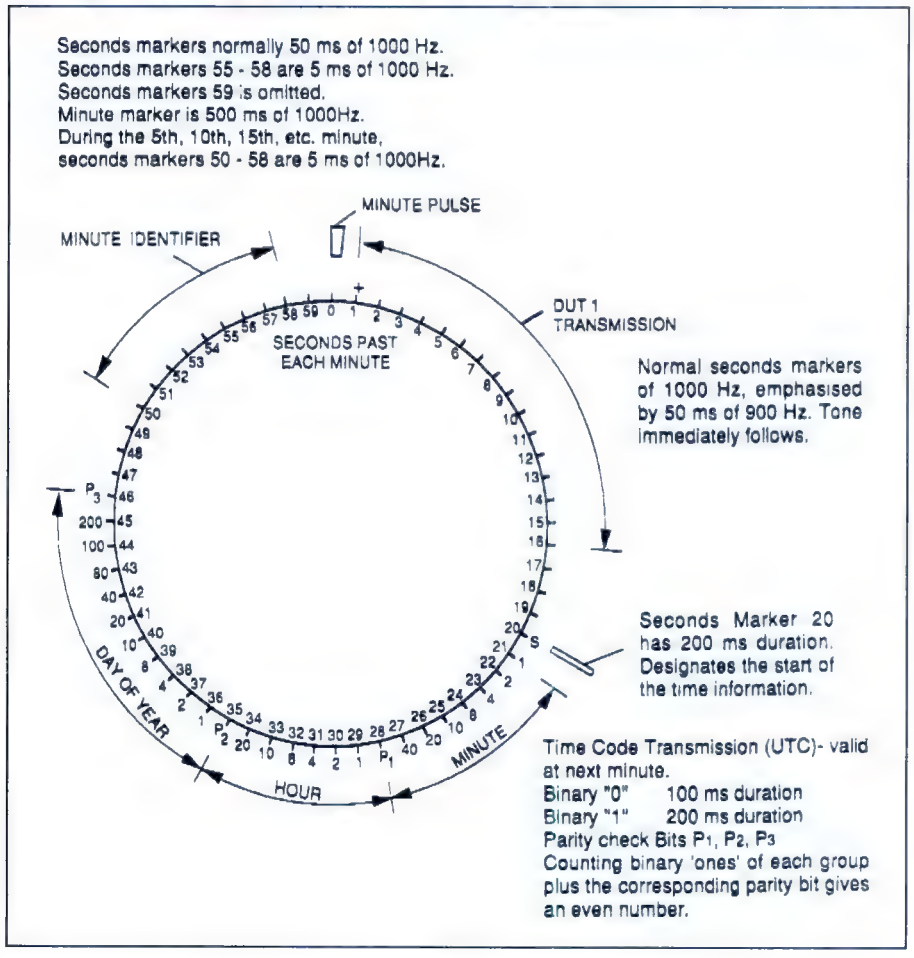


Fig.1: The time code format used by VNG for its transmissions.

transmission was meeting its requirements and therefore operating legally, it was decided on January 13 1989 to change over to a horizontally polarised Wells quadrant antenna of the type that had been used for the previous transmissions. The complaints of interference then stopped.

In late June 1989, an experimental licence was obtained to allow transmissions on 10.0MHz and 15.0MHz as well as 5.0MHz. Transmissions on the new frequencies were only from 2200 to 0700 UTC each day, in both cases using horizontally polarised quadrant antennas. By this stage the station's transmissions all carried voice announcements recorded by retired ABC announcer Graham Conolly.

Because of the number of other standard frequency and time signal services on 5.0, 10.0 and 15.0MHz, the four Canberra-based members of the VNG Users Consortium met with the then Minister for Communications Ros Kelly on August 30, 1989, to request alternative frequencies. Their preferred options were 4.5, 7.5 and 16.0MHz. However they were told that due to spectrum crowding, the use of out-of-band frequencies such as 4.5 and 7.5MHz would not be allowed.

The Department agreed to look into the possibility of allocating them 16.0MHz instead of 15.0MHz, however. This eventually bore fruit, and finally on March 16, 1991 VNG was issued with a licence for transmission on 16.0MHz. Transmissions on this frequency began at 0000 UTC on May 8, 1991.

In February 1990, DOTC had advised the Consortium that its temporary licence for 5.0MHz was to be converted into a fixed station licence, giving it permanent status.

However it also advised that the experimental licence covering 10.0MHz transmissions would not be renewed, when it expired at the end of November. After that time there would thus be a serious gap between the 5.0 and 16.0MHz transmissions — leaving quite a few users without useable signals at certain times of the day and year. So on December 7, 1990, Chairman Dr John Luck and Honorary Secretary Dr Marion Leiba of the VNG User Consortium approached the Royal Australia Navy, to request that VNG be permitted to use the Navy's time signal frequencies on 6.449 and 12.984MHz.

The Navy complied with this request, but reserved the right to take the frequencies back again at any time if it needed them. Subsequently the Navy decided to 'lend' its frequency of 8.638MHz to AUSLIG for VNG instead of 6.449MHz, to give it a better spread of frequencies.

DOTC issued a licence for operation on 12.984MHz on May 1, 1991, and for 8.638MHz a few weeks later on May 29. Frequency synthesisers for these frequencies were designed and built in the Geology Department of the University of Tasmania in Hobart by VNG contributor Vagn Jensen, who is a radio amateur and also Director of the Tasmanian seismograph network.

Official re-opening

VNG's transmission on 10MHz ceased on July 2, 1991 and the station began transmitting on the two 'Navy loaned' frequencies at 0006 UTC the next day.

The launch of the new transmissions was also used mark the official opening of the revived VNG, by Professor Julian Goldsmid the Chairman of the National Standards Commission. About 50 people attended the ceremony, with repre-

At left is shown the frequency and time signal generation equipment at Llandilo, while to the right is shown some of the antennas. (Photo courtesy Dr M Leiba).

sentatives from government organisations as well as members of the VNG Users Consortium.

VNG was now operating on a total of four frequencies: its own allocations of 5MHz and 16MHz, and those of 8.638MHz and 12.984MHz on loan from the Navy.

The 5.0MHz and 16.0MHz transmissions were carrying recorded voice announcements, but these could not be used for the other two frequencies due to international spectrum allocations. Instead these frequencies were carrying (and still carry) the message 'VNG' in slow Morse, for six times a minute. The staff at Llandilo designed and built the equipment to generate this.

On January 15, 1992, a new talking clock went into permanent operation on the 5.0MHz and 16MHz frequencies. Designed and built by Consortium volunteer Ian Pogson (a former staff member of *Electronics Australia*), it provides a voice time announcement in UTC immediately after each minute marker. (Ian has subsequently completed construction of a second talking clock, for backup purposes.) This was in addition to the voice station ID given during the 15th, 30th, 45th and 60th minuate of each hour.

The Consortium sought international approval for all four of its frequencies in July 1992, from the International Frequency Registration Board. In November 1992 it gained international approval for the 5.0MHz transmissions.

During 1992, it was decided to add a fifth frequency to the VNG range, to help users in the Sydney area who had experienced reception problems due to the radiation pattern from the existing horizontally polarised transmissions. A second-hand Harris-Gates 1kW transmitter was obtained, and set up on a frequency of 2.5MHz feeding a vertical antenna.

The first on-air tests took place on September 9, 1992, and after further work on both the antenna and transmitter by staff at Llandilo, it began 'permanent' operation on October 7.

An additional 10k W STC transmitter has recently been donated to VNG by the Department of Transport and Communications. Formerly used by Radio Australia in Shepparton, Victoria, its transport to Llandilo was arranged by the NSC, and AUSLIG paid for its installation.

A Melbourne member of the VNG User Consortium has been two identical digital voice announcement machines, to replace VNG's elderly cartridge machines. These have no moving parts, with the announcements stored in memory chips, and are expected to give a big improvement in reliability when they enter service shortly.

The most recent development in the VNG revival saga came in January this year, when the National Standards Commission succeeded in obtaining recurrent funding for the station. The NSC then took over the VNG licences from AUSLIG, and began funding its operations.

The VNG Users Consortium is still in operation, and providing liaison between users and the NSC. They're also involved in seeking funds for maintenance and upgrading of the station equipment.

Current status

After some five years of tribulation, Australia's time and frequency station VNG now seems to be firmly back in operation on an ongoing basis — thanks to the considerable efforts of the VNG Users Consortium and its volunteers, and valuable assistance from both AUSLIG and the National Standards Commission. Everyone concerned has every reason to be proud of what has been achieved.

The station is now broadcasting on 2.5, 5.0, 8.638, 12.984 and 16.0MHz, with continuous transmissions on the four lowest frequencies and from 2200-1000 UTC (0800-2000 AEST) on 16.0MHz. The three middle frequencies have an output of 10kW, while 2.5MHz has 1kW and 16.0MHz has 5kW. The time code broadcast on the transmissions is shown in Fig.1.

Although the National Standards Commission provides recurrent funding for the operation of VNG, the Consortium is still happy to receive donations to cover contingencies and improvements. If you'd like to assist in this way, your donation should be sent to:

VNG Users' Consortium
GPO Box 1090,
CANBERRA, ACT 2601.

On the other hand, requests for further information about station VNG itself, technical enquiries relating to its standard frequency and time transmissions, and reception reports should be directed to:

Executive Director,
National Standards Commission
12 Lyonpark Road,
PO Box 282,
North Ryde NSW 2113.

Our grateful thanks to Dr Marion Leiba of the VNG Users Consortium and Mr Ron Maxfield of the National Standards Commission, for their generous assistance in preparing this article. ❖

Simple D-I-Y VCR Servicing

Many common problems with video cassette recorders are caused not by esoteric faults in the VCR's fairly complex electronics, but by simple 'mechanical' faults like dirty heads, gummed-up tape guides or dried-out lubrication on rollers, gears and cams. As the author explains, this kind of problem can often be fixed just by using your commonsense, a little care and some simple tools.

by DARRYL BARTLETT

How is the performance of your video cassette recorder these days? Is the picture looking a little smudgy — or maybe it's covered with a blanket of 'noisy' white lines? If so, it's probably time to give the heads a decent clean.

Although you could just stick a head-cleaning tape in it for a few seconds, you run the risk of either not cleaning the mechanism sufficiently or damaging the heads through overuse of the tape.

Most head-cleaning tapes have a mildly abrasive ribbon fitted inside a regular case. When this kind of tape is laced through the mechanism it will, in theory, clean all the components of the mechanism that have become soiled with tape oxide.

There are two problems with this general approach. First, different components can become soiled to different degrees. For instance, the tape guides don't get very dirty since they have a highly polished surface that applies relatively little pressure to the tape; but the rubber pinch roller exerts considerable force and gets very dirty. This means that either some parts won't get cleaned properly, or other parts may be subject to excessive wear. Second, some components (like the capstan) get dirtiest at the outer edges of where the tape travels, and therefore don't get cleaned where they need it most.

Cleaning by hand is the preferred method of most servicemen. Not only can you give the video heads a thorough (but gentle) wipe, you can clean and lubricate the rest of the mechanism while you're at it. This is important not only to extend the life of your VCR, but also to protect your tapes — since deposits of magnetic oxide and dust on the various tape guides and heads can scratch your tapes and in turn cause them to dump even more oxide onto the VCR mechanism.

Although most manufacturers recommend that the heads be cleaned after about 500 hours of use, it's not unknown for nearly new machines to need a clean. It all depends on the quality and condition of the tapes you use. Strangely enough, price isn't a good indicator of quality since many low grade tapes are just as dear as the high grade ones. Using a respected brand is the only reasonable guarantee of quality.

Common symptoms

The exact faults caused by a dirty VCR mechanism can vary among machines and situations, but the general symptoms are easy to identify.

Extremely dirty video heads usually produce a wall of white 'tracking' lines over picture. These might cover the entire picture, or only a part of it. When the lines are at the top of the screen, they may hide the vertical sync signal and cause the picture to roll or jiggle. If the video heads are only slightly dirty, the picture may look a little smudgy and there may be a few tracking lines that don't disappear when you adjust the tracking knob.

If the sound is soft or distorted on either recorded programs or (usually to a lesser degree) on pre-recorded tapes, then the audio heads probably need cleaning. Fluttery or wonky sound indicates that the pinch roller and capstan are probably slipping and not pulling the tape through at a constant speed. This won't necessarily affect the picture since the speed and position of the video heads is constantly being monitored and adjusted to match the tape speed.

It's a good idea to clean and lubricate everything while the lid is off, even if there is only one part of the

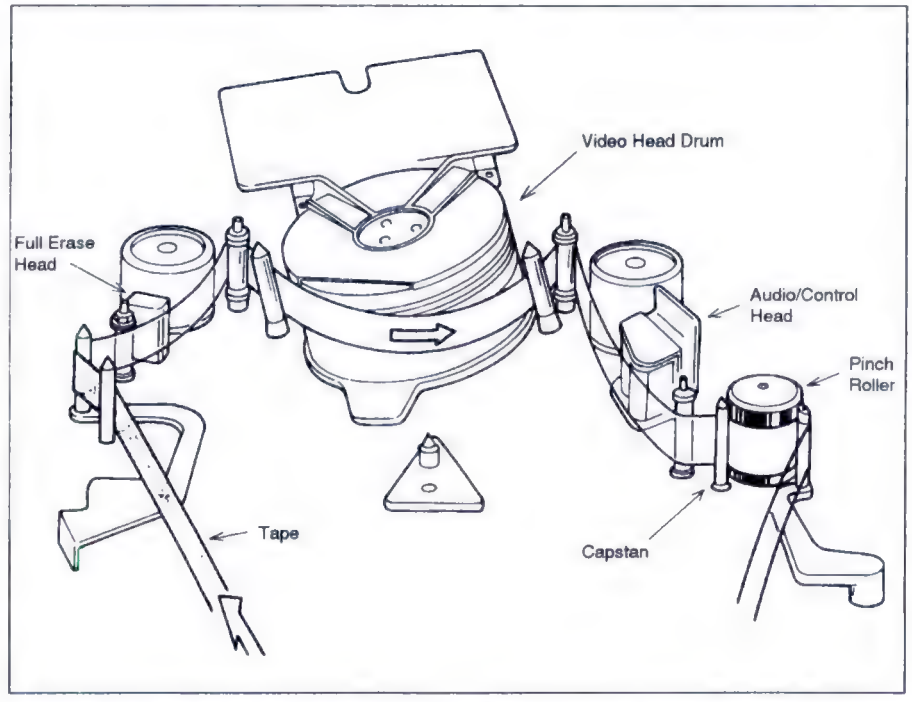


Fig.1: The basic components of a VHS video recorder deck, with labels showing the parts that most often require cleaning.

mechanism giving trouble. There's little point in saving five minutes work now, if you have to open the machine up again in a couple of months to clean a different part.

Precautions

Video heads are extremely fragile devices and need careful handling. NEVER use cotton buds, rags or anything that might snag on the sharp edges of the heads. Specially designed cleaning wands with a soft chamois leather surface are available for cleaning video heads. They're quite cheap and you should be able to get them from most repair shops.

Only disassemble the mechanism as far as is necessary. Removing the top cover and any internal shields is a straightforward process and shouldn't present any problems, but do not remove the cassette tray, front panel or anything else unless it's absolutely necessary.

Take note of which screws go where. There is a wide assortment of self-tapping and fine-thread screws in most VCR's. If you do get mixed up, just remember that the coarse-threaded screws usually go into plastic and the others fix into metal.

Don't use undue force on a stubborn part. If something won't move or come apart, you've probably forgotten to undo a screw or clip. Use your eyes, not your muscles!

Servicing

The first thing to do is remove the top cover. Depending on which model you're working on, there should be around two to six screws holding it on. These might be in the top (usually on the older models) or on the sides and back. Now lift the cover slightly at the rear and slide it backwards a bit until it's free.

Before you remove anything else, take a good look at the mechanism and decide what needs to come out to gain access to the video heads, pinch roller, capstan, tape guides and the audio/control head.

Fig.1 illustrates the major components that the tape contacts in a typical VHS-style mechanism. The large drum in the centre of the diagram houses the video heads. To the left of the drum is the full erase head, while the audio/control head is to the right. The pinch roller and capstan are at the lower right of the drawing.

The video heads protrude slightly through two tiny slots in the side of the drum, 180° apart. Machines with three or four heads usually have more than one head inside each slot. Some models have a large PCB (printed circuit board) mounted above the mechanical section. To remove this you might have to take the front panel off — as well as any small PCB's attached to it. The front panel may have a few screws holding it, along with a number of plastic clips. Most manufacturers indicate which screws need to come out by either putting arrows near the screws, or using coloured (usually red, gold or green) screws.

If there is a metal shield over the drum, then it will need to come off. This is usually as simple as loosening or removing a few obvious screws and sliding or lifting the shield off.

If you feel that the cassette tray must come out, check it over first. The eject mechanism should be easy to remove and reinstall if there is a small motor on the side of it, or if a rubber belt connects it to a pulley on the main mechanism. But if it's driven by a gear from the main mechanism, you will need to synchronise the gears precisely when you replace it. If this is the case, it's much easier (and safer) to leave it alone.

To remove the cassette tray, look for two to four small screws in the corners of the mechanism. You may need to undo some other screws, and the front panel may need to come off, but it shouldn't be too difficult to get out.

Now that the mechanism is accessible, you can finally get the isopropyl alcohol (or methylated spirits, although it's frowned on by the professionals), cleaning wand and cotton buds out. Dip the chamois wand into the alcohol/metho and gently rub the heads using a smooth *horizontal* motion. NEVER wipe the heads vertically — they are very thin and can break easily!

When the heads are clean, use the wand to remove any visible oxide from the drum. Be careful not to touch the sides of the drum with your fingers. The residue of acid in your fingerprints can, over time, degrade its polished metal surface. You shouldn't use the chamois wand more than once, so throw it out when you've finished. Use a cotton bud to clean the erase and audio/control heads, then wipe all of the tape guides and rollers that usually touch the tape. The capstan will probably need a bit of extra work since it usually gets very dirty.

I like to remove the pinch roller from the machine and clean it with an alcohol/metho soaked rag. You can clean it in situ, but it is much harder.

There are two common methods of securing the pinch roller to the shaft — a simple nylon cap that fits tightly over the shaft, and a small screw through the top of the roller. Removing the screw type is simple enough, but the nylon caps need extra care as they can readily break. If it won't come off easily, it's probably safer to clean the roller in the machine. Pinch rollers aren't always symmetrical, so check which way faces up before you clean it. Before securing it back it place, put a drop of light oil on the bearing.

Check that the existing grease on the cams, gears and guides is OK before you replace the covers. If the grease seems dry or dirty, clean it off and relubricate the part with a suitable graphite-based grease. If you don't have anything handy, don't substitute any old lubricant — it's better to leave it alone.

Put the machine back together, but don't put the top cover on yet — just in case you need to pull it apart again! If you pulled the cassette tray out, make sure you position it correctly before screwing it back in. It should sit hard against its mountings, with no springiness when you push down on it. Finally, check that you have re-attached any earth straps and flying leads that you may have disconnected.

Testing

Plug the machine in and play a known, high quality tape. If the picture looks good, try each function of the VCR (rewind, fast- forward, record, etc) to make sure everything is working correctly. If nothing is amiss, then put the lid on and give yourself a pat on the back.

If something is wrong then don't panic; you've probably made a simple mistake. Check everything that you've worked on. If necessary, pull it apart again and try assembling it from scratch.

If the picture quality hasn't changed, you may have a more serious problem that requires a serviceman's touch. If the picture's worse than before, check that you haven't damaged the video heads. If you think they are OK, try cleaning them again — it's possible that you smeared some oxide onto the head with the cleaning wand.

If it still won't work properly, get somebody to check over your work. Often a casual observer (unburdened with the details of the job) can see the obvious where you might miss it. If all else fails, swallow your pride and take it to your local serviceman. Tell him exactly what you did and what the symptoms are, and he should be able to sort out the problem fairly quickly.

In practice, most VCR problems turn out to be simple mechanical faults. While playing around inside a VCR has its pitfalls, a bit of commonsense and a light hand should keep you out of trouble. ❖

Moffat's Madhouse...

by TOM MOFFAT

The trooth about toobs

One of the most controversial articles in *Electronics Australia* last year had to be a construction project for a valve-based hifi amplifier. Enraged letters claimed the project was a serious slip back into the past, from a magazine that was supposed to be right up there with the latest in technology.

Then again, there were those (like me!) who drooled over the amplifier, remembering the big, gutsy sounds that used to emanate from such things — particularly home-made ones.

Well, I have discovered that we tube-troglodytes aren't alone in our past glories. There's a whole new generation of valvophiles developing among the punk rock and heavy metal head-bangers of this world. To get anywhere in that culture, to have made it as a musician, one must use a valve-based guitar amplifier. No, that's not right; not valves — the correct word is the American 'tubes', or better yet, 'toooobs'.

Current issues of guitar magazines abound with ads for giant amplifiers patterned after the rough-and-ready designs of the sixties. Big cases, big speakers, and undersized output tubes driven to the point of near-destruction.

Ironically these old-time amps were supposed to produce the ultimate in clean sound. But because an amplifier capable of 20 clean watts was promoted as a 100-watt amp, 'sixties guitar players expected 100 watts worth of sound out of them.

So the original valve amps were almost always run with volume full up, flat out, so that what came out of them was more distortion than signal. The player would hit a string and the amp would go 'THWAANNGGG' and resonate and reverberate in a most raucous manner.

This sound, the distortion, soon became the sound of the sixties, and it was more desired than the clear sound of a properly amplified guitar. Today's amplifiers can produce the same sound, either by faking it with an effects generator, or in a genuine overdriven tube-based output circuit.

The output of a guitar string is a damped vibration which dies away within a couple of seconds, but since the input level is several times what the amplifier can handle at the start, the amp remains overdriven even as the strength of the guitar string vibration dies away. So if you play several notes in quick succession, each new one gives the amplifier another belt before the previous string has died away. A simple little riff up the fretboard to the high notes becomes 'THWAANGG - AANGG - AANGG - AANGG - SCREEEEE!'

There you go. I'll bet you metalheads out there never knew I could play heavy metal on the keyboard of a word processor, did you. Do you recognize it? Bands like Metallica, Megadeath, Guns N' Roses? If you look at the recording level meter on a cassette recorder while this stuff is playing, you'll notice that the dynamic range is just about zero. The VU meters quiver gently around a fixed reading; the sound level is in constant overdrive, only the pitch of the notes changes (sometimes). It's the modern incarnation of the sixties sound, a whacking great square wave.

This distortion-as-art thing doesn't apply only to heavy metal. It's also popular in the more tuneful styles of music, like rock and blues.

And it's not just the young muso's who are into it (the first time I saw a picture of Axl Rose of Guns N' Roses I thought he was a girl). Guys like Eric Clapton (nearly my age, for God's sake!) and black guys a generation older like John Lee Hooker, are all into distortion, and to achieve this they need amplifiers that will distort. Hence the modern trend: reproduction vintage guitar amplifiers, with good old toooobs.

Here we get a bit technical; maybe a little oversimplified for purists, But you young pups sucked into this column by names like Megadeath are now going to get a quick dose of valve (toob) lore.

In my younger days I built quite a few valve-based stereo amplifiers, and even the occasional guitar amp. The general design of all these amplifiers is similar. The signal first comes to a pre-amplifier, usually two stages of amplification based on the two halves of a dual-triode valve such as a type 12AX7.

The amplified signal is then applied to a phase splitter, usually a 12AU7 or 12AT7, and then to a pair of power output pentodes such as type 6L6. Then comes an output transformer, and the speaker. The pair of output valves is arranged to operate in 'push-pull', which means that one handles the positive audio cycles and the other the negative cycles.

If you consider the speaker to be setting up sound waves by pushing air out and then pulling air back in, then one output valve is in charge of sucking and the other is in charge of blowing. For this to work properly it is important that the audio signal be split apart so that the sucking bits go to one output valve and the blowing bits go to the other. This is the job of the 'phase splitter' stage.

An electron valve is simply a device in which the flow of current through it is controlled by the amount of negative voltage on an electrode called the 'grid'. If there is no negative voltage at all on the grid, heaps of current can flow, and the tube will be slowly but surely destroyed. On the other hand, if the grid voltage goes negative beyond a certain point, valve current flow stops altogether and the valve is said to be 'cut off'. Here it is virtually shut down, doing no work at all.

Within an amplifier push-pull output stage, the grid of each tube is fed a negative 'bias' voltage which holds the 'standing' current at some value. The audio from the phase splitter is then superimposed upon the bias voltage to cause the current through the valves to fluctuate and thus vibrate the cone of the speaker.

In general, the more standing current allowed to flow, the less distortion there is in the amplifier's output. But more standing current means less efficiency; so there are three 'classes' of operation, depending on the performance needed from the amplifier.

In Class-A operation, the bias is adjusted so that current flows through both output valves all the time. It is like having two hands on the speaker cone all the time, one on each side, holding it and gently moving it in and out. Class A produces the cleanest possible audio with the least distortion, but it is terribly inefficient with all that standing current. There are still Class-A valve power amplifiers manufactured for the most dedicated audiophile, but they might use a pair of 6L6's to produce a niggardly 10 watts along with lots of heat and very short valve life.

In Class-B, the bias is set so that each of the push-pull valves is right on the point of cutoff, drawing only the smallest standing current. When an audio signal is superimposed, it causes one valve to pass more current while the other remains cut off. This is as if one hand pushes the speaker cone one way and then moves clear, while the other hand pulls the speaker cone the other way.

This is a good efficient system, squeezing perhaps 30 watts from a pair of 6L6's, but there is a problem of 'crossover distortion' while the amplifier is handing control of the speaker cone from one valve to the other.

In practice, Class-B is used only in circuits in which high-fidelity is not an issue, such as in the audio stages of two-way radios. Hifi amplifiers almost always use a combination of Class-A and Class-B, known as Class-AB.

Here the output valve bias is set so that there is a moderate standing current, and the system is running in Class-A during the time control is being handed over from one valve to the other. Only when crossover is complete is the current in the disused valve allowed to be cut off.

Now to Class-C. Here the bias is set well beyond the point where an output valve is cut off. So in a push-pull circuit, with audio applied, there is a point at crossover, and well beyond, where neither output valve is conducting. It's as if two hands are batting the speaker cone back and forth between them, and in between bats the cone is allowed to flap about with gay abandon, totally out of control.

Class-C is used extensively in radio transmitters where there is lots of filtering to remove distortion components, but in an audio system there is distortion aplenty, a head-banger's dream. In fact during World War II, the Allies used powerful Class-C audio amplifiers to harangue the enemy via big speakers mounted on jeeps. If the words didn't bother them, the painful grating distortion surely would!

We've just gone through all this gobbledygook because if you understand Class-C, you understand the secret of 'toob' guitar amplifiers in this day and age. Class-C operation can be brought about in just about any amplifier by grossly overdriving it with input signal. It eventually gets so bad that the grid voltage is driven from negative through zero to positive, and then current REALLY flows.

At this stage a transistor amplifier would most likely blow its guts, but valve amplifiers can take it because valves don't normally break down all at once; they cook to slow, but certain deaths.

'Overdrive' — a technical word we've used a couple of times — is now one of the trendiest features in a modern 'tube' amplifier. The 'Overdrive' control throws the amplifier into the roughest possible distortion. A clever way to implement this feature would be to simply drop some extra negative volts onto the grids of the output valves to bias them into Class-C. This would sound absolutely shocking — or great — depending on your point of view.

The amount of hype that surrounds these tube amplifiers far exceeds anything that's ever hit the hifi world. Forget your glass turntables, forget your monster speaker cables, forget your gold-plated input connectors and low-oxygen leads. The new tube-based guitar amps have hype that reaches beyond the stratosphere.

The image is rough-and-tough! Front panels of steel non-slip industrial decking, like you'd find in a refinery. Model names such as 'Bedrock' and 'Pitbull Classic' and 'Thunderfunk', and even one called 'THD'. That can only mean 'Total Harmonic Distortion', which I'm sure it has plenty of.

The modern 'toob' amplifiers mostly seem to use four good old 6L6's — or the heavy-duty version developed especially for hifi, the EL34 — in a push-pull parallel circuit. For this manufacturers are claiming up to 100 watts output, about twice what you'd expect with 'proper' design.

The higher power would most likely involve some kind of Class-C operation, overdriven to billy-o. These amps also have what's called a 'clean' mode, probably Class-AB, but I'll bet they wouldn't do 100 watts there.

To be considered of acceptable quality, there are certain qualities a tube amplifier MUST have. One is toobs. Really trendy amps have little windows for the tubes, so you can peer in at them and watch them glow.

I saw an ad for one amplifier in which not only were the tube heaters glowing, but their anodes appeared to be running white-hot. You'd want to carry around a bucket of spare 6L6's everywhere you went.

There are other amps with names like 'valvestate' but one suspects these contain MOSFETs, and that's a no-no.

A decent tube amplifier must be hand-wired, and the really flash ones have ceramic tube sockets. All the parts must be American made, and the inclusion of the occasional Taiwanese filter capacitor can put the kiss of Megadeath on an otherwise totally decent amp.

The use of any solid state device is truly bad form. Even the power supply rectifier should be a tube, even though any engineer worth his salt knows the power supply is the first thing to benefit from better regulation by the use of solid state diodes instead of tubes.

Reviews of these amplifiers point out every solid state device, but sometimes they grudgingly concede that they are 'not in the signal path'. One amplifier claims 'improved low-end definition due to power supply design' — have they perhaps discovered the dreaded silicon diode?

The ultimate insult you can hang on any amplifier is to suggest its sound has 'transistoriness'. That word is straight out of a review. But there's more hyperbabble: "The lower setting of the Hot Rod channel is dynamic enough to control lead and rhythm sounds from the guitar's volume knob; the amp's fat, squawky mids and big bottom add up to a punchy combination..." Is that his guitar amp, or his mother-in-law?

No, we shouldn't take the mickey out of these tube amps, even though the terminology used to describe them is sometimes colourful. I think the world would be a poorer place without them.

I remember this year's New Year's Eve party, out by the barbecue, swatting the mozzies, and this humungous Ghetto Blaster sitting there on the ground. Someone hit the button, and up came George Thorougood's *Bad to the Bone*: THWAANGGG-THUMPA-THUMPA-AANGG-AANGG! Feet started stompin' and stubbies started foamin' and it was a mighty good night. Thanks, in part, to Tooob Amplifiers. ❖

With Such A Wide Range of Multimeters, We Must Have One To Suit Your Needs!

OBIAT PTY LTD YOUR ONE TEST & MEASUR

Philips 90 Series – 50MHz Bandwidth Digital Storage Scope plus...

- 25MS/s 2 channel digital storage
- 8-bit,25 levels/div vert. resolution
- 10ns/div to 5s/div timebase
- Store 8 waveforms (95 & 97) and 10 set-ups (97)
- Measuring cursors (95 & 97)

...Full 3000 count DMM

- Functions include Min/Max, Touch Hold™, Relative & %, Autoranging etc
- dBm, dBV and dBW (95 & 97)
- 5 Soft Keys/Pop-Up Menus
- 12cm 240x240pixel Super Twisted Nematic LCD screen
- Floating up to 600Vrms
- Optical RS-232 Port (97)
- Low Power (4 hr internal battery)
- Built-In component and baud rate testers and a sine, square and ramp signal generator (97)

Model 93 Basic instrument **$1695 ex tax $1995 inc tax**

Model 95 Adds measuring cursors and recording function **$2180 ex tax $2565 inc tax**

Model 97 Adds waveform and set-up memories, back-lit LCD, generator functions, RS-232 interface **$2790 ex tax $3280 inc tax**

Fluke 10 Series – the only thing Fluke skimped on is the price!

For high performance at the lowest price, get your hands on a Fluke 10 Series...

- New V Chek™ determines continuity/ohms. Most of the time it's the only setting you'll need!
- New Min/Max recording with relative time stamp and Continuity Capture™.
- Autoranging with manual option
- Sleep Mode shuts down automatically.
- Capacitance from 0.001µF to 9999µF.
- Safety to UL1244, IEC1010, CSA and VDE
- Fast and accurate to 600Vac or dc plus ohms to 40MΩ

Fluke 10

4000 count digital display • 1.5% basic Vdc accuracy • Fast continuity beeper • Diode test • Sleep Mode • Two year warranty

$95.00 ex tax $111.00 inc tax

Fluke 11

Adds V Chek™ • Capacitance 0.001 to 9999µF • 0.9% basic dc volts accuracy

$120.00 ex tax $140.00 inc tax

Fluke 12

Adds Min/Max recording with relative time stamp • Continuity capture™

$145.00 ex tax $169.00 inc tax

Fluke 30 Series Current Clamp Meters

- True RMS with or without harmonics
- Up to 700A
- Frequency measurement
- Combined analog/digital readouts
- Min/max recording
- Smoothing for fluctuating currents
- Crest measurement

Prices from $385 ex tax $447 inc tax

Fluke 80 Series - the most popular Multimeter ever made by Fluke.

The Fluke 80 series is the first multimeter that can be truly called "multi".. it offers not only standard features, but special functions usually limited to dedicated instruments,plus innovations only Fluke can bring you. Like duty cycle measurement; or automatically store the highest, lowest and true average (mean) of readings for a few seconds or up to 36 hours; or record maximums and minimums for days; or the audible MIN MAX Alert™ that beeps for new highs or lows.

- ***Min/Max/Average recording stores highest, lowest and true average of all readings***
- ***Selectable response time to record turn-on surges or drift etc***
- ***1ms peak Min/Max hold on 87 to capture elusive transients or half-sine surges to 400Hz***
- ***Audible Min/Max Alert™ signals readings above or below previous limits***
- ***Splash and dust proof and impact resistant case***

83 **$450* ex tax $522* inc tax**

● Volts, Amps, Ohms, diode test, continuity, frequency and duty cycle, capacitance, Touch Hold™, relative, protective holster ● 0.3% basic dc accuracy ● 5kHz Vac ● Analog bargraph with zoom ● 3 year warranty

85 **$530* ex tax $615* inc tax**

● 0.1% accuracy ● 20kHz Vac

87 **$595* ex tax $690* inc tax**

● High resolution analog pointer ● True rms ac ● 1ms peak Min/Max ● 4 1/2 digit mode ● Back lit display

FLUKE

Bonus FREE Soft Carry Case this month

Fluke 45 Measures Two Parameters Simultaneously

- 0.02% DC accuracy
- 5 digit, 100,000 count
- True RMS
- Frequency to 1MHz
- Dual display
- Closed case calibration
- Standard RS-232 and optional IEEE-488
- 21 Reference Impedances for dB measurement

$1120 ex tax $1300 inc tax

Fluke 70 Series II... Fluke Adds to Range... Lowers Some Prices!

It's hard to improve on a classic multimeter, but Fluke rose to the challenge!

Three new multimeters - top-of-the-line Fluke 79 and 29 offer capacitance, frequency, fast 63-segment bar graph and other features plus entry level Model 70 delivers unparalleled Fluke quality and safety.

Models 73, 75, 77, 21 and 23 are all upgraded – all now have Touch-Hold™

Bonus FREE Soft Carry Case this month

Accuracy Comparison

Range	*70*	*73*	*75(21)*	*77(23)*	*79(29)*
Vdc	0.5%+1	0.4%+1	0.4%+1	0.3%+1	0.3%+1
Vac	2.0%+2	2.0%+2	2.0%+2	2.0%+2	1.0%+2
Ohms	0.5%+1	0.5%+1	0.5%+1	0.5%+1	0.4%+1
Adc	NA	1.5%+2	1.5%+2	1.5%+2	0.5%+2
Aac	NA	2.5%+2	2.5%+2	2.5%+2	1.5%+2
Frequency	NA	NA	NA	NA	0.01%+1
Price (ex tax)	**$125**	**$185**	**$270**	**$295***	**$370***
Price (inc tax)	**$145**	**$215**	**$313**	**$342***	**$429***

** includes Holster as standard*

STOP DISTRIBUTOR OF ING INSTRUMENTS

With Such A Wide Range of Multimeters, We Must Have One To Suit Your Needs!

Black★Star Video Monitor Tester 1410

● Covers most standards in a single instrument – checks MDA, CGA, EGA, Hercules, PGA, VGA, SVGA, 8514A, XGA and TV formats ● Microprocessor controlled ● Intelligent alphanumeric display ● Analog RGB, TTL-IRGB, Secondary RGB, Horizontal/Vertical/Composite syncs ● Colour Bars, Test Card, Crosshatch, Dots, Ramp, Focus, Horizontal Lines, Vertical Lines, Raster and Checkerboard ● Full control over output signals ● 15.625 to 48.5kHz Line Frequencies ● 49.9 to 87Hz Frame Frequencies ● Inverse Video ● Separate Analog and TTL Outputs ● Easy Connection via 9-way and 15-way 'D' and BNC Connectors

$1250 ex tax $1438 inc tax

Black★Star Orion PAL TV/Video Pattern Generator

● Tests TV, VCR, Monitors etc ● PAL B, D, G, H, I, K ● RF, Composite Video and IRGB Outputs ● Separate or Mixed Syncs ● Trigger Output ● Colour Bars, Greyscale, Crosshatch, Dots, Lines, Focus, Purity etc. ● Over 50 pattern combinations ● 1V or TTL IRGB ● 5.5, 6.0 and 6.5MHz Sound Carriers ● Internal/External Sound ● Mains Operated

$725 (ex tax) $834 (inc tax)

TestCard Monitor Test Software for PC's

● Choice of 16 foreground colours & 8 backgrounds ● Test patterns - focus, dots, lines, grating, shades, checkers, test card, raster, greyscale etc

$115.00

Black★Star 3210MP/3225 Bench Multimeter

● Portable but not pocketable ● 3 1/2 digit ● 0.1% (3210MP), 0.25% (3225) accuracy ● True RMS (3210) ● Mains/battery (3210MP) ● Ideal for schools

from $315 ex tax
$362 inc tax

Sadelta TC402C Field Strength Meter

● Digital LCD frequency display for tuning ● Covers all TV and FM frequencies 45 to 862MHz ● Seven ranges cover 26dB/µV to 100dB/µV ● Large level meter calibrated in dB/uV and Vrms ● Ohmmeter for passive continuity checks

$ 750 ex tax $878 inc tax

DIC SC7000 Desoldering Tool

● Compact and Multi-Functional ● Integrated diaphragm vacuum pump ● Carbon loaded housing for good electrostatic discharging ● Hot air setting for SMD removal ● 100W ceramic heater

$480 (ex tax) $575 (inc tax)

AEMC Current Probes

Clamp-on current probes extend the measuring capabilities of multimeters, loggers and recorders etc. The AEMC range measures currents down to 1mA and up to 3000A ac or dc. Check your application with us and we will recommend a suitable probe

Appa 90 Series

• 3 1/2 digit • 41 segment Analog Bar Graph (96 & 98) • Autoranging •Frequency Counter (98) • Capacitance Range (98) • Data Hold • Memory Offset (96, 98) • High contrast, large digit LCD for easy wide angle viewing (Models 96 and 98 also have an analog bar graph display to easily follow rapidly changing displays) • Unique probe storage holder grips for easy display reading while making two-handed measurements. The holder doubles as a handy storage case for the probes • Auto Power-Off when not in use to extend battery life • Water Resistant – Models 91 & 96 are designed for harsh environments to IP 64 • Shock mounting and thick-wall design guarantee that these multimeters survive a 1.5m fall to a concrete floor • Versatile Tilt Stand swings out to 45° and hooks over a cabinet door or swing the stand out to 90° for a handy level stand • All models are designed to meet Class II IEC 348 and UL 1244 standards for the safest operation in all applications

Model	*91**	*96**	*98**
No of Digits	*3 1/2*	*31/2*	*3 1/2*
Bargraph	–	✓	✓
20A current	–	✓	✓
Capacitance	–	–	✓
Frequency	–	–	✓
Transistor Test	–	–	✓
Offset	–	✓	✓
Data Hold	–	✓	✓
PRICE ex tax	***$109***	***$149***	***$189***
inc tax	***$127***	***175***	***$220***

Appa 76 RC "Meterplus" Component Tester

• Companion to your multimeter • Tests resistors, capacitors, trimmers, VR's, Diodes, LEds, Transistors, SCR's, Batteries etc

Brief Specifications

Capacitance: 200pF to 20µF
Resistance: 200Ω to 20MΩ
Transistor Hfe, Leakage, Iceo
Hfe: 0 to 1000 npn/pnp
Iceo: 10nA to 20µA
Diode: Approx forward voltage
LED: Approx forward voltage
Battery:
9V: 15mA load
1.5V 150mA load
1.5V Button 0.8mA load
SCR: Pass/Fail

$129.00 ex tax ***$151.00 inc tax***

Appa 23 Digital Engine Analyser

• 8 Functions: Volts, Amps, Ohms, Dwell, Tach, Duty Cycle, Diode Test, and Continuity Buzzer • Large 0.8" digit, high-contrast LCD readout • Automatic power shut off extends battery life • Single rotary switch simplifies function selection • Drop proof • Water resistant

DC VOLTAGE: 200mV to 200V ±(0.5% + 1d)
TACHO: 0-10000 rpm x 10, 0-2000 rpm ±(1.5% + 50 rpm)
DUTY CYCLE: 0 -100.0% , ±(1.5% + 2 d)
DWELL DEGREES: Range: 0-90.0° (4 cyl) 0 - 72.0° (5 cyl) 0 - 50.0° (6 cyl) 0 - 45.0° (8 cyl), ±(1.5% + 2 d)
RESISTANCE: 200Ω to 20MΩ, ±(0.75%+ 4 d)
DIODE & BUZZER: O/C Voltage: 3.2V max
DC CURRENT: 15A, ±(2.0% + 3 d)

$129.00 ex tax ***$151.00 inc tax***

FREE 32 PAGE SHORTFORM CATALOGUE AVAILABLE NOW

32 page catalogue and detailed brochures and specifications available. We are factory trained to advise on your requirements for general purpose Test & Measuring Instruments. Ask about our Account facilities and special arrangements for Education and Government Departments. Express delivery can be arranged throughout Australia and South Pacific.

OBIAT PTY LTD READER INFO NO. 11

129 Queen Street, Beaconsfield. P.O.Box 37 Beaconsfield NSW 2014
Tel : (02) 698 4776 Fax : (02) 699 9170 Call us for name of your local stockist

bankcard VISA MasterCard

When I Think Back...

by Neville Williams

Murray H. Stevenson - 1: A pioneer who 'grew up' with our first commercial broadcast station

The son of a wireless/radio pioneer in the 1920's, Murray Herman Stevenson was himself a virtual co-founder of 2UE, Australia's oldest commercial radio broadcast station. For good measure, he went on to coordinate the technical resources behind ATN — key station of the successful Seven ('Prime') television network. We recount his story in this article and two which will follow.

I first became aware of the Stevenson family in the early 1930's, when as a country lad just out of high school, I stopped short outside 'Radio House' in Pitt St, Sydney — obliquely across the way from Anthony Hordern's (then) huge emporium. (It's now an equally huge development site.) I was fascinated by the Radio House display of electrical and wireless gadgetry: batteries, switches, wires, sockets, globes, bells, buzzers, nuts, bolts, lugs and terminals, condensers, transformers, valves, headphones, tools — everything enthusiasts ever dreamed about.

It was all there on show: new, shiny, tagged and meticulously arranged to catch the eye of passers-by.

The shop was run by the Stevenson family, I was told, father and sons — except for the eldest son, Murray, who had inherited the job of chief engineer of the family radio station, 2UE. To a kid with one hesitant foot on the bottom of the career ladder, to be 'chief engineer' of a radio station sounded quite awesome.

Little did I realise that Murray and I would one day become firm friends, and that it would be my privilege to summarise his life story in 'Australia's Top Selling Electronics Magazine'. This after several lengthy phone conversations to confirm the details, of course.

It turned out that the hearsay about 'Radio House' had been broadly correct.

The year it began

First-off, in thumbing through old magazines, I 'struck oil' immediately in the first issue of *The Australian Wireless Review* (January 1923), where a Mr C. Stevenson was featured with a dozen or so other industry identities 'waiting to talk to' prospective readers about wireless and the likely introduction of public broadcasting later in the year. At the time, the only signals audible on air were shipping traffic, impromptu amateur transmissions and occasional demonstration concert broadcasts.

Fig.1: C.V. Stevenson, the father of Murray, pictured in 1955 as 'The Grand old man of broadcasting'. Founder of 'Electrical Utilities' and 'Radio House', he was also a co-founder of 2BL and of 2UE, Australia's first commercial radio station.

Mr C. Stevenson (Fig.1) was listed as the proprietor of the Electric Utilities Supply Co in George Street, Sydney (Fig.2), which was said to have been operating for six years. He was described as a long time experimenter who had built up a reputation both as an equipment designer and component supplier. His specialty was in the use of 'the Myers valve', said to be notably gas-free, with five times the gain of normal types and an ability to oscillate with a plate supply in the range 3 to 200 volts.

(You'll find a section on Myers brand valves in John W. Stokes' helpful book *70 Years of Radio Tubes and Valves*.)

But was Mr C. Stevenson the father of Murray, and if so, how did Electrical Utilities of George Street, Sydney get to be Radio House in Pitt St?

The answer to the latter question was suggested by adverts in the February and March, 1923 issues of *AWR*, which carried the name 'Electrical Utilities' in small letters (this time, spelt with an '-al') but with 'RADIO HOUSE' emphasised in capitals (Fig.3) — signalling a pending name change.

It was at this juncture in my 'thinking back' that I rang a long-since retired Murray Stevenson at his Turramurra (NSW) home, and was greeted with a cheery response and gratifying recall of names and events from the early days of radio.

Murray confirms it

Yes, said Murray, the aforesaid C. Stevenson most certainly was his father

— C.V. Stevenson. A qualified electrical engineer, 'CVS' had set up business in George Street, becoming progressively more 'hooked' on wireless technology — an involvement that his family could scarcely ignore when, during World War I, he/they had set up home on vacant floors directly above the shop.

Murray said that he, himself, had been born in the original family home in Leichhardt, Sydney, on April 17, 1905. The eldest of four children, he was followed by Les (1907), Norman (1912) and Evelyn (1913).

He had attended Sydney Technical High, gaining a good pass in the leaving certificate and a scholarship to study chemical engineering at tertiary level. His heart wasn't in it, however, and as an avid reader of technical literature, he opted out to concentrate on electricity and wireless — with his father as mentor and guide.

After all, said Murray, his father had been dabbling in wireless since before the 1914 - 18 war, and had been receiving overseas transmissions on the primitive equipment of the era.

And yes, Murray had helped out in the family business in the city until he got caught up in 2UE. But in the longer term, his brother Les was the son most directly involved in Electrical Utilities/Radio House, especially following its move to the Pitt Street address.

I asked Murray about a smaller branch shop that I remembered further down Pitt Street, across the road from the Royal Arcade. That, I gathered, was an interim venture, the more lasting expansion being into the Royal Arcade itself, where the Stevenson family took over the historic shop formerly occupied by Miss F.V. (Vera) Wallace (later Mrs C.R. Mackenzie — see *EA* for April 1992, pages 47,49).

Appropriately, 'Radio House' advertisements in postwar magazines and catalogs (e.g., *R&H* May 1951) carry the address of *both* shops — 296-8 Pitt Street and 6 Royal Arcade.

(The current phone directory lists two or three 'Radio House' shops in the City and suburbs. Stocking made-up equipment rather than components, they are still managed by a Stevenson — Barry, son of Norman).

First broadcaster

But getting back to the George St premises, Murray recalls that after WW1 Electrical Utilities had to vacate the original building at 605 George Street, when it was targetted for re-development. The family itself moved into a new home at Maroubra while the company transferred into premises only a few doors away, at 619 George Street. Here, too, they had an upper floor, but it remained largely vacant during the early 1920's. It was in this space that the transmitter was assembled for 2BL — Australia's first public broadcasting station — on behalf of Broadcasters Ltd.

While the company name sounds suitably formal at this remote point in time, Murray says that, in reality, it was a 'scratch' group of wireless retailers, with a common desire to see a licenced broadcasting station on the air. The registered address was at the Stevenson's shop.

How the station was to be supported in operation was not clear. Ernest Fisk and AWA were promoting the sealed-set scheme in the face of strong opposition by the public. Broadcasters Ltd also opposed it, preferring unrestricted listening and sponsorship by advertisers. The position was resolved, some months later, with provision for both A-class and B-class stations, the former relying on licence fees collected and disbursed by the Government, and the latter on advertising revenue.

Meanwhile, firms like Anthony Horderns, David Jones, Colville and Moore, W. Harry Wiles, Vera Wallace, L.P.R. Bean, Bergin Electric and Electrical Utilities continued to contribute £5 per week to get the project under way, with publisher W.J. MacLardy as manager and C.V. Stevenson as treasurer.

Murray's story of what followed is more colourful than the account in Ray Allsop's biography in our February, 1990 issue. As he recalls, most of the actual construction work was done by a Mr E. Joseph, but the steel-framed transmitter was so bulky that it could not negotiate the doors and stairs leading to the street. (Yer gotta laugh!)

The only remedy was to pick a Sunday morning when George Street was deserted, remove a complete window assembly from the front of the building and hoist the transmitter out over the footpath to a waiting truck. In due course, it was set up on the roof of the *Guardian/Smith's Weekly* newspaper building as per the earlier story.

While the appearance on air of what became 2BL caused a mini-sensation in the wireless fraternity, the performance of the transmitter left much to be desired. So it was that young engineer Raymond Allsop, attached to New Systems Telephones Ltd, inherited the task of reworking the installation ready for the official opening on November 23, 1923 as a provisional A-class station.

By all accounts Ray did an excellent job, subsequently becoming chief engineer of the station. (In his biographical notes, Ray quotes the power rating as a nominal 500 watts.)

As a 'story on the side', Murray Stevenson recalls an occasion, shortly after the station went to air, when an itinerant salesman called into the family shop in George Street with a line of decorative salt and pepper shakers. Perhaps Mr Stevenson would like to carry them as a novelty?

Nothing came of the proposition but, while in the shop, the caller heard the sound of music: "What's that?" When told that it was from a wireless set tuned to the new broadcasting station, the man was vastly intrigued and inquired as to where the station was.

Not only did he later call to inspect it, but he talked himself into a job as announcer. "What's more", said Murray, "he became quite famous! His name — George Saunders"!

For me, the name stirred a faint chord of memory, but the only hint of it I could find in old 2BL programs was as one of the station's much publicised announcers/uncles — Uncle George. "That'd be him", said Murray, "I remember now, we used to call him just that!"

Scooping Smithy

When aviators 'Smithy' and P.G. Taylor were returning in the crippled aircraft Southern Cross from the abortive Jubilee Mail flight to New Zealand in May 1935, 2UE staffer Arthur Carr scored a memorable news scoop.

He was atop a water tank above 2UE's then Pitt St studios, maintaining contact with colleague Si Meredith who was among the many station representatives at Mascot awaiting the historic return.

From his vantage point, through a telescope, Carr spotted the Southern Cross flying in over Cronulla. Grabbing a pair of field glasses, he went on air at once, minutes ahead of everyone else.

Pioneer advertiser

According to C.V. Stevenson, the first 2UE advertiser to really show what radio could do in the selling field was probably 'Youth-O-Form' slimming tablets, which spent a few pounds per week on spot advertisements. Excess weight was apparently no less a problem then than it has been in later years.

"Each morning after we aired the spots, there would be long queues waiting outside the shop at Rosebery".

First commercial station

With A-class stations beginning to appear on-air, C.V. Stevenson learned from James (Jim) Malone, at the time Chief Manager of Telegraphs and Wireless for the Commonwealth, that the Government was ready to consider applications for a commercial station licence.

"Would I be eligible?" asked C.V. Stevenson, to which came the reply "Why not?"

So it was that a provisional licence was duly granted for 2EU (Electrical Utilities), with the suggestion by Jim Malone that they consider changing the proposed call-sign to 2UE — by reason of 'its more euphonious sound'. Feeling that he had made his fair contribution to 2BL, CVS sold his Broadcasters Ltd shares to Sir Samuel Hordern of Anthony Horderns Ltd.

Wasting no time, the Stevenson father and son repaired to the new family home at Maroubra where they set about to design, build and install a functional — if primitive — broadcasting station, complete with aerial.

In short, in 1925 and at age 20, when many of his peer enthusiasts would have been preoccupied with amateur style equipment, Murray was cutting his technical teeth on a family owned broadcasting station — destined to be Australia's first commercial (B-class) public broadcaster.

In a *B&T* magazine lift-out celebrating 2UE's 30th anniversary in 1955, the power of that first transmitter was said to have been one 500th of their prospective 5kW limit — which Murray insists is in error. It would have been 150W or more, he says, involving two jumbo-size triodes. One served as a self-excited oscillator, the other as a modulator, preceded by as many audio stages as necessary to boost the signal from a transverse-current carbon microphone.

From then on, the history of 2UE was marked by an on-going upgrade in technical facilities under the guidance of the Stevenson duo and covering transmitters, studios and associated facilities. Murray was officially installed as Chief Engineer in 1931 and as a director of the Company in 1940.

An early initiative, pictured in the abovementioned *B&T* lift-out, was a studio control box contrived by Stevenson Snr. With just four control knobs on the front and a turntable and electric pickup on top, it allowed discs to be played straight to air instead of through a wind-up phonograph and a carbon mic. *B&T* magazine claimed it as a 'first' in Australian broadcasting.

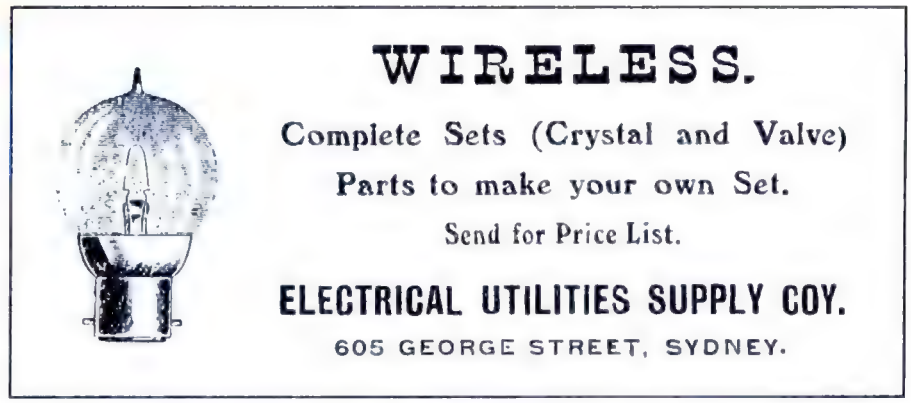


Fig.2: An advertisement from the Electrical Utilities Supply Co in the very first issue of 'Wireless Weekly', August 4, 1922.

As Murray recalls, the original allocated wavelength — near the middle of the band — was 292 metres (around 1025kHz). Before the widespread adoption of crystal control, it was the operator's responsibility to set and maintain the transmitter on the allocated wavelength, hopefully minimising frequency drift and/or 'wobble' with modulation.

Practical problems

The Stevensons' responsibilities in this respect were underlined when the transmitter was first put on air. An urgent phone call from Sydney's Garden Island Naval radio station informed them that their signal was interfering with a maritime emergency channel on 600m (500kHz).

It could have been a receiver problem, or the new transmitter might somehow have been radiating a subharmonic. So without further ado, Murray and his father had to consult with the Radio Inspector, re-check their frequency and, as well, discover how best to suppress possible harmonic radiation.

The station finally opened on January 26, 1925, with programs each evening between 8pm and 10pm. Said Murray: "I looked after the equipment and my father did the talking."

It was an interesting period, with both men absorbed in their new hobby/occupation — albeit one that, at first, yielded little in the way of financial reward. Initially, the only advertising content was for their own shop!

The hours of transmission were gradually extended, as also was the range of their activities, to keep pace with Stevenson initiatives and listener expectations.

Foreshadowing 2UE's ultimate reputation as a sporting station, they became involved in racing and football —

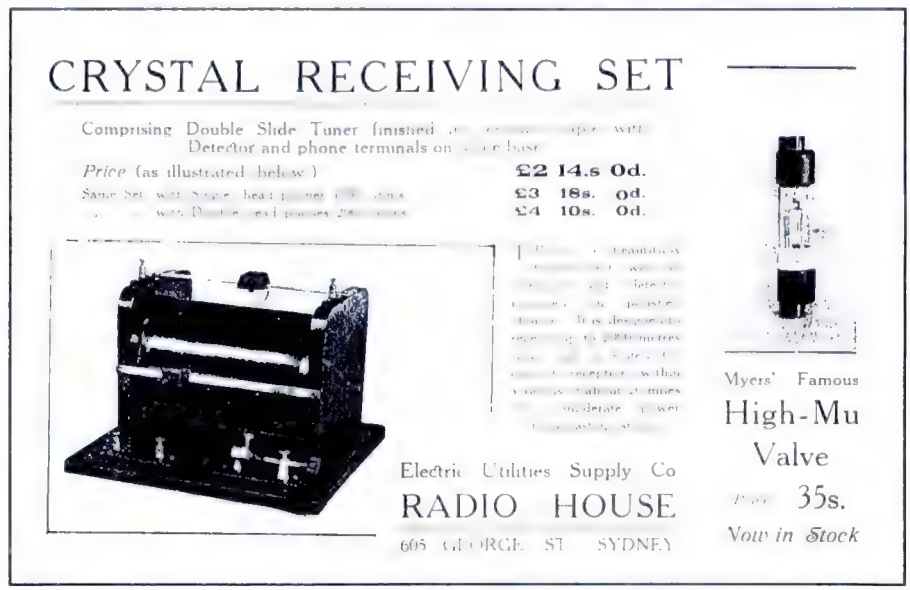


Fig.3: In this 1923 advertisement the 'Electric Utilities Supply Co' logo gives place to 'RADIO HOUSE'. It also promotes the Myers valve.

without the co-operation of the promoters. If they ventured inside the grounds, they were expected to pay at the gate, like everyone else! Their preferred ploy was therefore to 'borrow' a window or balcony overlooking the arena and broadcast from there!

In 1928, they got a break of a different kind when a committee set up by the Catholic Church in Sydney asked whether they would be prepared to broadcast proceedings at a coming Eucharistic Convention, with follow-up sessions during the succeeding months. The church would pay a modest fee to help cover expenses.

"Well, it's like this"

Murray said that he explained to the priests involved, Fathers Meany and Walsh that, as a Protestant, he was not familiar with Catholic formalities. Their response was to show him around Sydney's St Mary's cathedral, explaining the layout, the procedures and the areas where microphones would be required. They also indicated that space could be available in a temporary Convention office to serve as a talk studio.

In the Cathedral, Murray was conscious of private devotional activities and asked how communicants would react to people laying cables and setting up microphones in consecrated areas. "It would be no different", the priests said, "from any one else performing essential duties".

"In fact", one of them added with a twinkle, "we'd prefer it to be done by Protestants, because they wouldn't be expected to know any better"!

"What on earth would you have done for microphones?" I asked Murray while he was describing their Convention broadcasts.

"Transverse current types", he replied, "home-made out of wooden blocks fitted with a rubber diaphragm".

"A *rubber* diaphragm? — I've only ever heard of mica..."

Said Murray: "We always used dental type sheet rubber. It was of very high quality, uniform from batch to batch and easy to fit once you'd worked out how."

Responding to the challenge, the Stevensons also set up a city studio on the vacant floor above the George Street shop, with a phone link to Maroubra and a separate street entrance for broadcasters. Father Walsh, a Shakespearean scholar of note, became a regular visitor who was not above shedding his formal vestments on a hot day, to broadcast in comfort.

"In fact, I got to respect the priests as very human people", said Murray.

"The one man who remained studiously formal was Dr Rumble, an outspoken ecclesiastical scholar and a very contentious figure in those days. As a former Anglican cleric who had converted to Catholicism, he was given to debating the conflicting points of view and, at the drop of a hat, would launch into dissertations that were often over my head!"

"From our point of view, the Convention was a godsend. For months on end, the Catholic Church provided around six

Fig.4: From the IREE (Aust) files, this photo of Murray Stevenson was taken in 1948-49. Having lived through the entire hifi era, he is loud in his praise of CD recordings played through a modern amplifier system.

hours of programming per day — including huge functions at the Town Hall and Randwick Racecourse. They publicised the station, rallied an audience — and paid us one pound per hour for the privilege'!

A major move

These days, it seems like a trifling amount but the Stevenson family appear to have managed, with C.V. deciding to brighten his middle age with a new 'weekender' on a bushland property at Lilli Pilli, on the southern fringe of Sydney — with easy access to Port Hacking — a popular fishing spot.

Why not transfer 2UE to the same site?

This involved construction of a new and updated transmitter, along with a new antenna — a horizontal 4-wire 'birdcage', with a matching birdcage centre feed, supported between two 180ft (55m) windmill-type towers. It certainly looked the part, on rising ground, with a clear path to the city and beyond.

Unfortunately, it looked better than it actually performed. With hindsight, Murray explained that transmitting antennas were not well understood in those days. Station personnel tended to regard reception reports from far-flung locations as evidence of extensive coverage. They didn't quite realise that every watt of RF energy in random lobes, reflected by the distant ionosphere, was energy diverted from the station's basic regional coverage.

In commercial terms, advertisers needed to promote products to listeners in their own area — not over in Perth, Darwin or Auckland!

Reading up on the subject, Murray Stevenson realised that while the antenna was out in the clear, the ground beneath was mostly dry and non-conductive.

His answer was to install a counterpoise beneath the aerial, comprising an earthed wire mesh supported a few inches (or cm) above the ground.

In his book *Australian Radio — The Technical Story 1923-83*, Winston Muscio nominates Murray Stevenson (Fig.4) as a notable example of Australian station engineers who had designed and installed their own transmitters, rather than relying on traditional suppliers like STC and AWA.

As an indication of the scale of such an enterprise, he says that the 2UE installation at Lilli Pilli ended up with a pair of STC 4228-A water cooled valves in a final linear amplifier. He continues:

The valve filaments were heated by a motor-driven generator set and the high tension by two 2000 volt motor-driven generators connected in series.

Apart from valve replacement, maintenance of the water cooling system and frequent attention to the high voltage generators, this transmitter operated satisfactorily from 1930 to 1942.

Having traced the story of Murray Stevenson and the family radio station from their humble beginnings in 1925 to mid-term in the late 1930's, we progress in the next of these articles to the more elaborate and complex technology which emerged in the 1940's and 50's as radio broadcasting had to re-position itself to meet the challenge of television.

(To be continued) ❖

FORUM

Conducted by Jim Rowe

Sundry unhappy readers take Mr Comer — and me — to task

The April contribution by Arthur Comer on the subject of 'back EMF' in inductors certainly produced a healthy crop of letters from other readers — many wanting not only to take issue with him, but with me too, while they were at it! I'm publishing a selection of these here, plus another gently critical one that came in a short while ago on another topic almost guaranteed to cause arguments: do polyester capacitors cause distortion in audio amplifiers?

In addition to those responding to Mr Comer's comments about his claimed misuse of the term 'back EMF', a further letter also arrived from the man himself, seeking to clarify his position. Apparently he hadn't realised how his first letter might be misunderstood, and wanted another opportunity to explain exactly what he'd meant. So in fairness to him (after all, he did raise what is obviously a topic of interest), we'll give him the opening bat:

Thank you for publishing my 'back EMF' letter in the April 'Forum'. I made the letter as short as possible, and some confusion has arisen as a result.

First, my reference to writers who 'clearly didn't understand' inductance referred to those who (a) stated that the voltage across an inductor when DC was applied was a 'back EMF'; (you have agreed with me that it is, in fact, a PD), and (b) showed, for an inductor with AC applied, two anti-phase waveforms, labelled 'supply' and 'back EMF', but showed no such waveforms for the capacitive case. As my letter stated, in both cases EMF and PD change places every 90 degrees, as energy is alternately taken from, and returned to, the supply.

One point still needs clarification. Let us look at your relay circuit, complete with its overswing diode, a standard arrangement. When we break this circuit, energy, equal to $1/2LI^2$, exists in the magnetic field. It can't just disappear, so the current can't instantly change either direction or magnitude. So the magnetic field becomes an electron-moving force, but not a voltage, continuing current flow, and building up a PD across the distributed capacitance of the winding, ie, the magnetic energy becomes electrostatic energy (less losses). Only when the current falls to zero does this PD become an EMF, forcing current back the other way. If no losses were present this system would oscillate forever. So it is not that a voltage maintains the current flow so much as that the current flow produces a voltage! Are you still happy with 'back EMF'?

Assume for a moment both diode and relay are perfect, lossless, components. When the circuit is broken, current will continue unchanged, forever, but without any voltage in the circuit at all!

Finally, on the subject of relays. Every textbook I ever saw (including the old PMG notes we used at RMIT twenty years ago) showed an exponential rise in current when power was applied — but this is clearly false. If you think carefully you will conclude, as I did, that current will begin an exponential rise, fall sharply, then rise more slowly to its final value. How could all those people get it so wrong?

I know space is at a premium in EA, and there are many exciting topics, but I hope one day you can print the above.

Hmmm — thanks for those further comments, Mr Comer, but I have to admit I still can't quite see what you're driving at. I was following you until you wrote 'So the magnetic field becomes an electron-moving force, but not a voltage, continuing current flow and building up a PD...' How can the field cause the current to continue flowing, without doing so via an induced EMF?

Still unclear...

I'm sorry, but I'm personally still quite happy with the term 'back EMF', and more puzzled than ever about exactly *why* you don't like it.

I don't understand your claim that the textbooks are all wrong about exponential current rise in a relay, either — or are you basically saying that there will be an abrupt fall in current when the relay's armature pulls in, due to the sudden fall in magnetic path reluctance, and hence a rise in winding inductance? If so, I guess there would be a drop in current at that point, and then a slower exponential rise again... Perhaps you'll write again some time, and clarify at least what you are getting at with regard to relays.

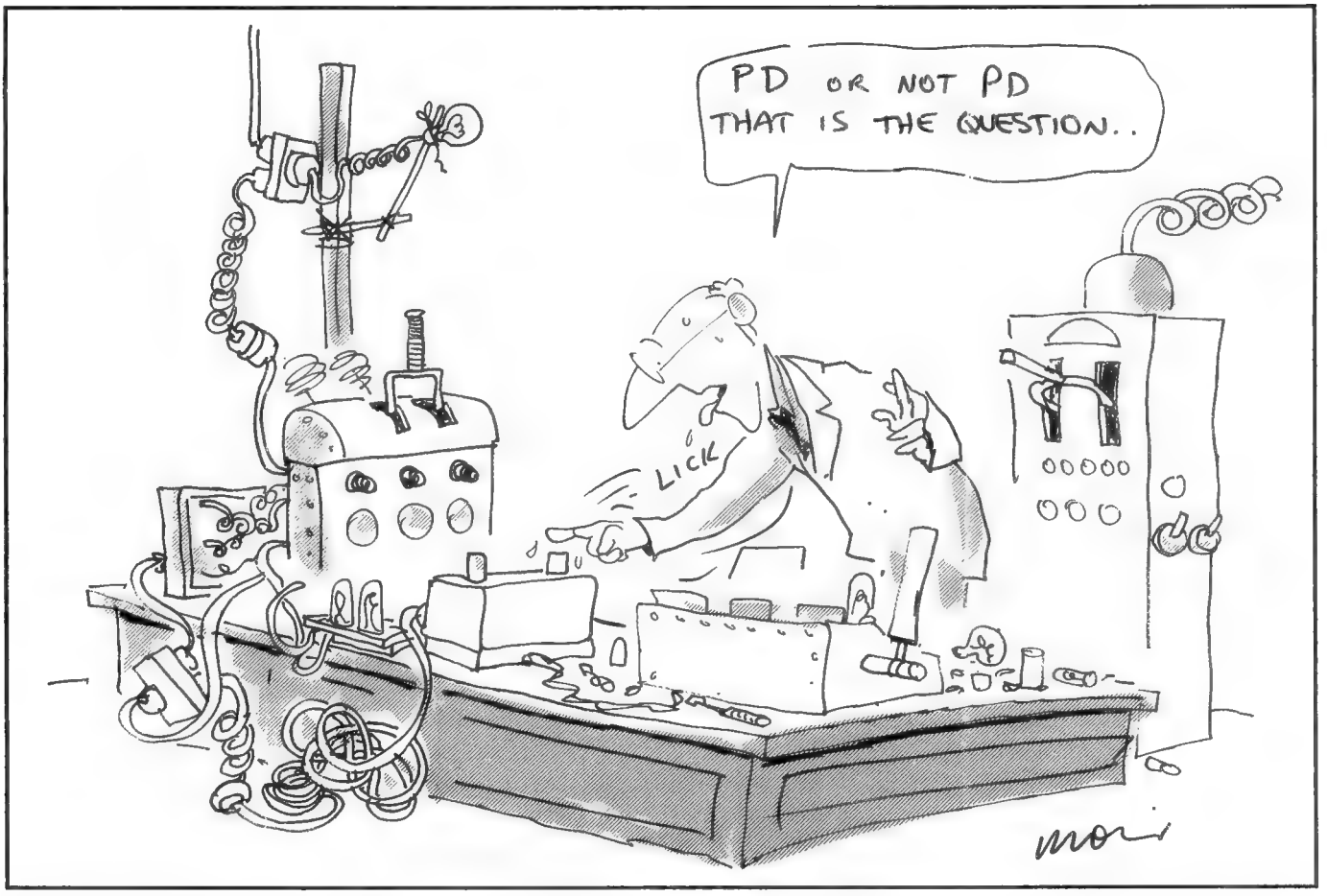
What others wrote

In the meantime, let's turn to some of the people who responded to Mr Comer's first letter. The first one comes from Kevin May, VK5JV, of Kangaroo Ground in Victoria. Mr May enclosed some diagrams to illustrate the points he makes, and I've reproduced these here too. Here's what he has to say:

I would like to respond to the letter from Mr Comer in which he has expressed his dislike for the term 'back EMF'. But before I do so, may I say how much I enjoy the Forum column each month. It's always interesting to read the discussion, and never dull.

Now to the topic in question. I find it hard to see why Mr Comer wants to insist on his particular definitions of EMF and PD. I doubt that he is using the terms in a way that standard texts would, and I think that may be the source of his problem with the term 'back EMF'. Let's look at what the terms PD and EMF mean. If we get them straight first, the rest will follow easily.

Logically, PD, or potential difference, exists wherever two points are at different electric potentials. This applies irrespective of whether current is flowing in a circuit. PD does not necessarily indicate a power-consuming device. Consider for example a charged capacitor. If there were no leakage in the dielectric, a



PD would always exist between the terminals once it had been charged, but it would not consume power. If you think there's no PD, try it with a wet fingertip if you dare! Similarly, a PD exists between the terminals of a battery unless it is totally exhausted, whether or not current flows in it. A passive device like a resistor exhibits a PD between its terminals when a current is made to flow in it.

An EMF (electro-motive force) is that force which has the ability to drive electrons from one place to another. It may originate commonly by chemical action, as in a battery, or through a changing magnetic flux in a loop of conducting material, as in a dynamo, alternator, or transformer.

*Fig.1 shows a simple cell in which the EMF maintains a potential difference between terminals A-B. R represents the total resistance of the circuit, including the internal resistance of the battery. If switch S is closed, the battery's EMF produces a current I flowing in the circuit according to Ohm's well-known law E = I*R. We can generalize the circuit by replacing the battery with a circle representing an ideal source of EMF, which could be a battery or a dynamo, etc. See the equivalent circuit in Fig.1(b).*

Now let's think about what happens when the load is inductive (see Fig.2). L represents the total inductance of the circuit, and R is again the total resistance. At the moment switch S is closed, current begins to flow. The increasing magnetic flux in L induces an EMF in it. Let's call it E_1, and we know by Lenz' Law that $E_1 = L*di/dt$ where small i is the instantaneous value of the current. Now the polarity of E_1 is such that it tends to maintain the original unmagnetized condition of the inductor, so it opposes the current flow. We can legitimately represent the equivalent circuit as in Fig.2(b). Thus, $E = i*R + L*di/dt$. This takes into account the additional source of EMF within the inductance due to changing magnetic flux and, I trust, makes the situation clear.

In due time the current i reaches its steady state value I, and its rate of change has decreased to zero. Now $E_1 = 0$, and $E = I*R$ once again.

If now switch S is opened, the total resistance of the circuit suddenly increases to a very high (not infinite!) value. R is now negligible compared with Rs and may be ignored. The current i decreases very rapidly in L, inducing in it an EMF which is still $E_1 = L*di/dt$, but this time with opposite polarity, tending to maintain the flow of current. See Fig.3. E_1 is very large because di/dt is large, and so is the potential difference across the switch, which is $i*Rs = E + E_1$.

A diode if connected across L has the effect of providing a path for current to continue flowing in L until it decays to zero. It avoids the excessive potential difference across the switch — and anything else in the circuit. See Fig.3(c).

Referring back to Fig.2, I can see no problem in calling E_1 a back EMF. It opposes the applied EMF E as current rises. And in Fig.3 it opposes the fall of current by adding greatly to the total EMF in the circuit. It is the fact of its opposition which leads to the use of the term back EMF.

Furthermore, I cannot see the logic of Mr Comer's use of the term PD in his letter. In limiting the use of the term PD to power-consuming devices he has taken away its natural meaning, and I believe that this leads to inevitable confusion. For instance, he says 'the inductor...becomes a PD', and 'the circuit EMF and PD change places'! These statements defy commonsense. So let's stick to the usual terminology, as it does make sense. I'll vote for back EMF any day.

Thanks for your comments, Mr May. It looks as if we're in broad agreement regarding the events associated with the

production of a back EMF, although I note your point about the strict definition of a PD being simply a difference in potential rather than a sign that energy is necessarily leaving the circuit. You're quite right, of course, and I should have stressed this myself. Your detailed explanation of storing energy in the inductor and then having it returned again does provide further clarification, too.

And now let's move to the next response, which came in the form of a somwhat terse fax from Mr Ken Wagnitz of Adelaide in South Australia. Mr Wagnitz is apparently a Principal Technical Officer for Telecom, and as well as responding to Mr Comer also threw in a couple of brickbats for yours truly:

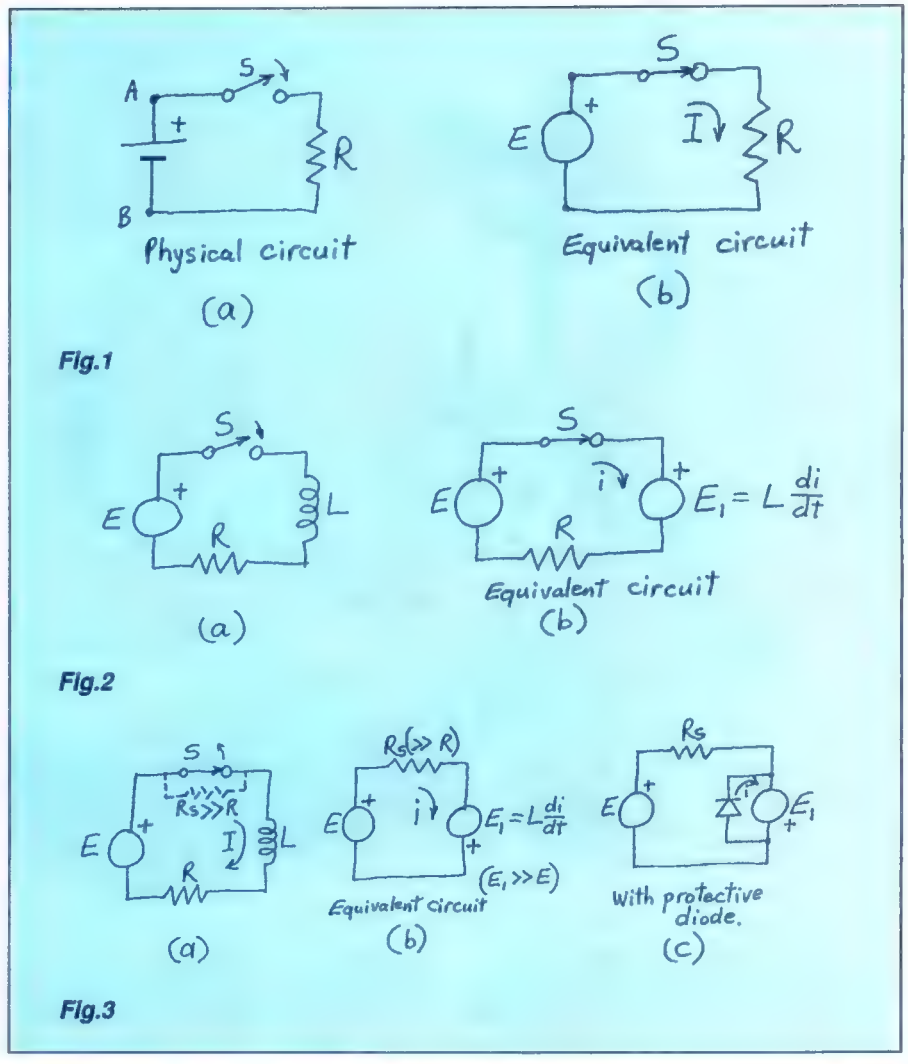
I can't stay silent any longer. Once again you have mentioned clock-radio = brain tumour (April 93 Forum). Correct me if I am wrong, but I think you have a one track mind (involving electrons). Think: What type of clock (or watch) face which is visible in the dark, is KNOWN to cause cancer? So far you don't seem to have thought of it.

Regarding Mr Comer's objection to 'back EMF', my first reaction is 'who cares?'. You waste quite a bit of space on discussion of the idiosyncratic beliefs of individuals, when there is so much new and interesting factual stuff to inform us (your readers) of. (Of course I do not have any idiosyncrasies!)

Since you didn't define the acronyms EMF and PD, I assume that PD does not stand for 'Pseudo Dialogue' or some such, but Potential Difference. In that case, a PD cannot 'extract(s) energy from electrons' per se, since it can exist across an open circuit, where such an effect is out of context.

The behaviour most people use the term 'back EMF' to describe (I think), is where the inductive device causes the voltage or PD across it, to reverse from what was connected to it. At that point, the device is able to act as a voltage source, rather than sink, i.e., provide an EMF (Electro Motive Force) backwards to the previously applied voltage. The fact that it tries to maintain the current flow in the same direction is irrelevant to the term, given that EMF is measured in volts, not amps. In short, I agree with you. 'Back EMF' appropriately describes what it is usually applied to. Please don't dwell on this in future issues.

Thanks for your comments too, Mr Wagnitz, even though they're not exactly complimentary. You seem a bit amazed to find yourself in even broad agreement with my conclusions about back EMF, and in any case don't appear to think it's a subject that is worth much attention...



The diagrams sent in by reader Kevin May VK5IV, to illustrate the points made in his letter on the subject of 'back EMF'.

I take your point about luminous paint on watch and clock dials being a known cause of cancer, but rightly or wrongly I had assumed that few — if any — clock radios in current use would use this type of dial. Frankly I'm still inclined to believe this is the case, too. I understand clock and watch makers have been prohibited from using radioactive paint for many years now.

Wasting space?

As for whether discussing things like back EMF in Forum is simply 'wasting space on discussion of the ideosyncratic beliefs of individuals', space that might be better spent informing readers of new and interesting factual material, you're of course entitled to your opinion. Perhaps you're right, too. Sometimes I'm inclined to think the same way, especially when I'm in the middle of designing or testing a new project, and I realise that I have to knock off to prepare the latest Forum!

The reality seems to be, though, that Forum is one of the most popular sections of the magazine. A great many readers seem to appreciate the way it lets them comment on technical matters that concern them, and also for the way it has a 'leavening' effect on the magazine.

By the way, I do note your reminder concerning the same point made by Mr May, about a PD not necessarily being associated with an extraction of energy from the circuit. My face is suitably crimson!

The next response came from Mr Gordon Wormald, of Florey in the ACT. Mr Wormald is commenting not only on Arthur Comer's criticism of back EMF, but also on the earlier item in the April column about possible health risks from ELF fields:

I would like to throw a couple of ideas in among what, I am sure must be the thousands of words that you have and

will receive on topics discussed in the April EA:

Concerning ELF fields, your attempts at an objective approach to the question is applauded (just gimme the facts, man). In this vein, one aspect of the situation seems continually to be overlooked — almost all discussion admits to the presence of electric fields and/or magnetic fields and then blithely goes on to lump them together under the term 'Electric or Magnetic Field' (EMF). From then on, there is usually concentration on one of these to the exclusion of the other, building in the assumption that they have equivalent effects.

Electric fields arise in the space between conductors at different electric potentials, for instance between an EHT powerline and earth. Magnetic fields arise in the space around conductors from the flow of current in them, for instance underneath the same powerline. The first is proportional to the line voltage but independent of current (i.e., it is still there even if there is a break in the line further on), while the second is proportional to line current but independent of voltage so that street powerlines may have a greater magnetic field below them than under cross-country lines. Real-life situations usually involve exposure to both sorts of field, but their relative magnitudes can vary widely, and it may be that we should be more careful about exposure to one than the other. But which?

It is conceivable that the body may be affected by either sort of fie]d, but the modes of action must be different, and any examination or attempt at explanation of supposed effects should be careful to distinguish between the two. For instance Dr Rapacholi's proposed large-scale experiment with mice subjected to 'strong EMFs' should be rather more informative if some lived in a magnetic field, some electric, and some in both (in case there is synergy, each reinforcing the other disproportionately).

If $1.5 million is to be spent on testing as your quote from an AESIRB article suggests, it would be sad if this aspect is not carefully attended to in the design of the experiment. Unfortunate]y, the quote does not inspire confidence in this regard, mentioning magnetic fields in its para.4 and accenting voltage in para.7.

Mr Comer's obsession with 'back EMF' is unfortunate in that he is casting aspersions on a valid and venerable term which is to a large extent self-explanatory. His misunderstanding appears to stem from his arbitrary order of the terms in the relationship

$$I.di/dt + I.R = V$$

which others write as

$$R.I = V - L.di/dt$$

The minus sign recognises the importance of Lenz's Law (defined in 1834) which says that inductive effects produce EMF's opposing the tendency to change current in inductors. This is how it came to be called 'back EMF'.

His 'own' definition (and that of texts which are 'better' because he agrees with them?) is obviously faulty in that inductors extract energy from electrons while storing energy and impart energy to electrons when releasing it (to which you rightly drew attention). On his definition, inductors should sometimes be counted as PD and sometimes as EMF. Of course the same goes for capacitors, too.

Frankly, I thought the term 'EMF' started to fall into disuse about the same time as 'condensers', and for much the same reason: inexactitude....

I recognise a PD every time I see it on an oscilloscope plugged into two circuit nodes. To me an EMF looks exactly the same, and I see not the slightest utility in not calling it a PD, taking due care with polarity of course. I am supported by William of Ockham and his famous Razor.

Speaking of hates — I hate inconsis-

tency, especially of the sort displayed by Mr Comer in setting out his equation (the first of those above). As a teacher he should realise that putting constants before variables in all terms of an equation can help in its analysis, and that not to do so betokens either careless or untidy thinking.

Well, there you are: a serve for Dr Repacholi about the design of his ELF experiment, and also a couple more for Mr Comer. Still, at least I didn't get one myself, that time!

Thanks for your comments though, Mr Wormald. I think you're right about the term 'EMF' being rather less often used nowadays — but then 'PD' isn't used all that much now either, is it? Most of us tend to use the term 'voltage' to cover them both, perhaps out of laziness — although as you say, it has the advantage of simplicity and does seem to work quite well providing you take care...

By the way, how did William of Ockham's Razor come to be re-named 'Occam's Razor' by many people? Is it simply laziness again, or is 'Occam' a legimate alternative spelling? Not that it matters, of course; it's the Razor itself that's important — and like you, I regard it as a very useful thinking tool. If there's no difference between the ability of two theories to explain the facts, and one is simpler, it's surely the more preferable.

Polyester caps, DCC

And now to end off this month, let's turn to a letter that came in a couple of months ago, but I haven't had the opportunity to give it space before this. It's from Graham Byrnes, of Brunswick in Victoria, and Mr Byrnes is having a gentle dig at both Louis Challis and myself, in two different audio matters:

I realise you have closed discussion of audio cables etc, but I'd just like to provide a couple of tangential thoughts. Firstly, I applaud your attempts to inject some sanity into this region: EA provides one of the few counter-weights to the 'informed opinions' of the hifi press. However, may I be permitted a gentle prod at your integrity?

In your September issue you published the description of a valve-type amplifier. All well and good, to each their own, etc., etc. I appreciated your italicised comments at the end too. However... in the midst of the article, the author claims that:

'it is not advisable to use polyester capacitors for signal coupling, because of their high distortion.'

Now personally I draw the line at using electrolytics as coupling caps (as in all the EA amp designs I've seen!), due to stored charge effects, asymmetry etc. Yet even they have very low measured distortion. The difference between a polyester and a polypropylene cap must surely be 3/5 of bugger all, especially compared to the 3% distortion levels generated by the valve amp as a whole. I could cope with 'better sounding' or some such vague term (some people seem to like distortion, after all), but it seems a bit off to make such a factually nonsensical claim in a technically oriented magazine such as EA.

Next thought: Perhaps it would be appropriate to occasionally kick some better connected heads, too. For example, it would be nice to have some discussion of whether we really need Philips' DCC. In his review, Louis Challis notes that

'the average older person... will more than likely purchase pre-recorded cassettes...'

Why on Earth would they do that if they already have a CD player? It now seems certain that pre-recorded DCC's will not be cheaper than CD's. Why go to the extra expense of a recording medium which has inherent durability problems from tape/head wear, just to replay expensive pre-recorded software? I have often wondered: suppose the record companies had supported DAT with software, would it have sold any better? I frankly doubt it.

It seems to me that one buys a recorder to record. Now once upon a time we all needed to record our LPs, so we wouldn't wear them out by listening to them. Well, CD killed that. Sometimes it would be nice to record programs off-air, but personally I'm never organised enough to tape the commercially unavailable stuff and the rest I'd rather buy on CD to get good quality. The extra cost is not such a great factor if the rumours I've heard on blank tape prices are correct! The only other circumstance in which one might record and play back on the one machine is if you make your own live recordings. That market would fit in the back of a large bus, and has already bought DAT anyway.

So that leaves recordings made to be replayed in cars, walk-things etc. Yet at the moment they will not play DCC. A home DCC deck is useless until you have one in the car, or a portable. Which makes the whole backward compatibility thing a waste of time for home decks, since they need to be compatible as RECORDERS with the pre-existing decks, not for play-back with pre-existing tapes.

Does any of this matter? Yes, it does. If record stores have to duplicate their lines on CD and on DCC, they have two options. They can increase the amount of money tied up in inventory, or they can cut back on the number of titles carried. Guess which is most likely during a recession? They can't drop their current cassette lines until most buyers have replaced their old analogue cassette decks. Since cassettes are mainly bought by the young and impecunious, their rate of DCC uptake is likely to be slower than the change from LP to CD.

So the fact that LaTrobe University record shop still has more LP's than CD's for sale doesn't auger well for music lovers. It doesn't matter much to Philips, since their aim is to sell everyone a second copy of Dire Straits and Elton John's greatest hits. How good their aim is remains to be seen.

Thanks for your comments too, Mr Byrnes, and I'm sorry it's taken a while for them to be published. I take your point about Mr Tan's reference to the 'high distortion' of polyester capacitors; I left it in the original article so as not to impose my editorial censorship on him unduly, but I *had* intended to make reference to it in my comments at the end — and then forgot to do so!

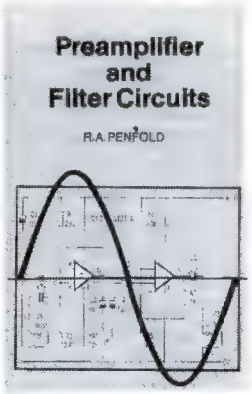
I have to agree with your evaluation of the difference in distortion between polyester and polypropylene caps, too — in fact, you may well have over-estimated it significantly. As for your comments about DCC and its likely market reception, you may well be right there too. But only time will tell, as you say yourself.

Like you, I'm inclined to think that if DCC takes off its market will predominantly be in the area of car audio and 'walk-things'. I can't see it taking over from CD's for home reproduction, and I'm a little puzzled that Philips and the other firms promoting it seem to have launched it on the market with a top-end component recorder. Still, we may yet turn out to be wrong.

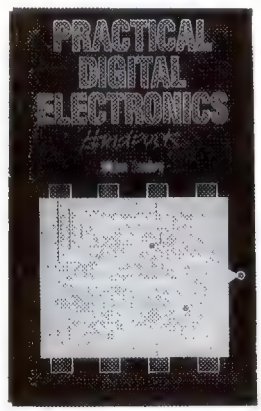
And that's it for another month, folks. I hope you'll join me here again in the Forum next month. ❖

Electronics Australia

BOOKSHOP



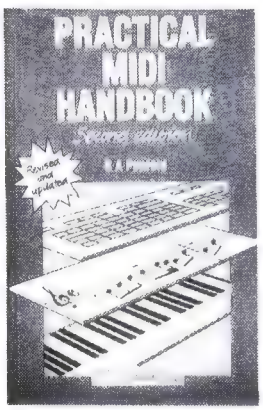
Preamplifier and Filter Circuits
This book provides circuits and background information for a range of preamplifiers, plus tone controls, filters and mixers. The circuits described are simple and previous experience of electronic project construction is not needed.
CODE: BP 3090 PRICE: $11.00



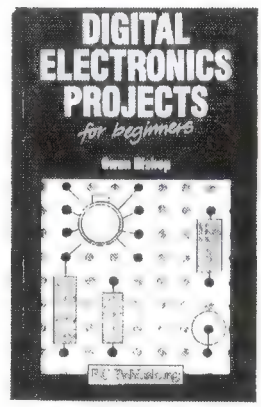
Practical Digitial Electronics Handbook
This book introduces digital circuits, logic gates, bistables and timers as well as microprocessers, memory and input/output devices. It will prove invaluable to anyone involved with the design, manufacture or servicing of digital circuitry.
CODE: PC 1004 PRICE: $22.95

Introducing Digital Audio, CD, Dat and Sampling. - Second Edition:
This book bridges the gap for the technician and enthusiasts who have worked with audio circuits. It includes oversampling methods and bitstream techniques and technical terms.
CODE: PC 1007 PRICE: $22.95

Computers and Music - An Introduction:
This book explains how to simply set up your own computer music studio. It covers the basics of computing, running applications programs, wiring up a MIDI system plus everything about hardware and the programs.
CODE: PC 1006 PRICE: $27.95



Practical MIDI Handbook
Refers to the powerful capabilities of MIDI and how to exploit it, with no knowledge of electronics or computing. It reviews the latest developments in MIDI covering keyboards, drum machines, sequences, mixers, guitars etc.
CODE: PC 1002 PRICE: $22.95



Digital Electronic Projects for beginners
This book provides simple, yet detailed instruction on practical projects. Covering instrumentation to home security plus circuit diagrams, this reference book also offers 'fun' projects for newcomers to electronic construction.
CODE: PC 1011 PRICE: $19.95

HOW TO ORDER

To order, simply fill in the coupon, remembering to include the code numbers and $5.00 postage and handling. If the coupon is missing, write down the names, code numbers and prices of the books you require. Include your name, address, phone number, plus cheque, money order or credit card details (card type, card number, expiry date and signature) and send it all to Federal Publishing, Reply Paid No. 3, PO Box 199, Alexandria, NSW 2015. Please allow at least 28 days for delivery and please sign all orders.

THE SERVICEMAN

Two taunting tales of (gulp!) temperature-related intermittents

It's high summer as I write these lines, and I'm not the only device that fails to work properly when the temperature climbs above 35°C. I detest hot weather, and a lot of electronic equipment also objects to elevated temperatures. This month we have two stories about temperature-dependent faults — one from my own bench, and one from a regular correspondent in Northern Queensland. There's also a very interesting story about a faulty MIG welder...

I'll let my own story of a temperature-dependent intermittent fault start this month's proceedings, if only because it turned out to be so frustrating that I want to get it off my chest!

Last month, you may recall, I told at some length the story about the problem with my son's BBC microcomputer, and how I 'repaired' it by accident. Hardly had I finished writing that piece when the screen of the monitor on my own computer (another BBC, remember?) filled rapidly with random characters.

(Actually, the first thing I noticed was that the 'word count' displayed by my word processor was decreasing at a faster and faster rate! The word processor counts the spaces between character groups and uses this as an indicator of how many words have been entered. What was happening was that the computer was replacing the spaces with random characters, thus reducing the word count!)

As it happened, I had been working for some time on a hot and muggy day, so when the computer crashed, I gave up in disgust, switched everything off and went to the fridge for a cold beer.

When I returned next morning, the computer worked perfectly, as though nothing had happened. It continued perfectly for a couple of hours; then after morning tea, it began to crash again. Not quite so dramatically, this time. But slowly and inexorably the word count fell, and the remaining words became more and more garbled.

It was just by chance that I realised that the weather had cooled a bit since the previous day, and that this could be a significant factor in why the machine was failing more slowly than it had done the day before.

I soon had the cover off and when I switched the power back on, the fault had cleared. It stayed clear until later that afternoon, when the ambient temperature had risen noticeably. Then once more, it was filling the screen with garbage. It didn't take long to realise that I had a temperature sensitive fault in one of the 30-odd chips that populated the board. My problem was to find and replace the dodgy one...

I soon had a new can of freezer spray on the desk beside me, and began the wait for the fault to re-appear. The clearest indication that the fault was present was a steady decrease in the word count. As soon as the count started to drop, I 'hit' one of the chips with the spray.

This didn't do any good, so I hit another, then another. Eventually, I had frozen every chip on the board without doing anything worthwhile. Then, I realised that whatever the fault was, it was becoming locked into memory and would not be cleared until I reset the computer. So I began a new series of tests, and reset the computer after each spray burst. I kept this up for an hour or more without any clear result. Then I noticed that the evening had come on and the ambient temperature had dropped. So the faulty state was less and less frequent.

After tea, I was able to finish writing the story I had begun before the computer went crazy. The problem was that if I was ever going to find this fault, it would have to be done in the heat of the day!

Next morning, when things had begun to warm up again, I sat down at the computer to start another story. When the word count began to fall, I started in again to spray and reset, spray and reset...

Eventually, I had sprayed everything along the back and centre of the board and began to work my way along the front. There are a few memory chips at the right hand edge of the board, then the big Acorn video processor chip that featured in last month's story.

After I hit this chip, and reset the computer, everything was back to normal. So it seemed as though that might be the source of the trouble. I repeated the process two or three times, just to be sure, but the result was pretty convincing. With the cover off the computer, it took a somewhat longer time for the problem to reappear — but even a brief spray on the video chip restored everything to normal.

So, my problem was now what to do about it. As I mentioned last month, I believed that a replacement video processor chip would be unavailable. (In fact, I have since learned that a replacement *is* available, although some modifications to the computer are necessary to make it run properly.)

The fact that the chip worked perfectly,

so long as it was kept cool, prompted me to see if I could devise some way to do just that. The first idea was to see if I could fit a fan somewhere inside the case.

The BBC has a very low profile case, and even the smallest fan available would prevent the case from closing properly. I could have mounted the fan off the board and ducted the air to where it was needed, but that seemed like a very messy way to do the job.

While I was wondering about what I could do to cure the problem, I casually ran my fingers along the row of chips that included the video processor. As soon as I touched that particular item, I yelped and quickly pulled my burned finger away from the offending chip. It was as hot as all get out!

Quite obviously, something was drastically wrong with the chip. Just fanning it would not be enough to keep it cool — it would need quite a powerful blast of air to do that job. Then I had the idea of fitting a heat sink to the chip. A low profile black body would take a lot of cooling, but a similar body with a lot of additional surface area should be much easier to control.

It so happened that only a day or so earlier I had wrecked an old AWA 4KA colour TV chassis and the audio chip in that model, an SN76033N, was fitted with a large, ornate, six-finned fan shaped heatsink. I have a dozen or more of these chips laying around, so it was no sacrifice to remove the heatsink from one of them and dispose of the bit that was left.

The bottom of the heatsink was shaped to mate with the small audio chip and was quite unsuitable for the larger video processor chip. I put the heatsink in the vice and used a coarse file to level it down to suit its new occupation.

Then I put a copious dollop of heatsink compound on the chip and pushed the new attachment down into intimate contact. There was no easy way to clamp the chip and heatsink together, but as the computer is rarely moved, I took the chance that the assembly would remain intact without a clamp.

The computer worked perfectly when I switched back on, and continued so for several days. The acid test came a week later, when the ambient temperature climbed back into the high 30's by mid afternoon. I ran the computer for two hours in the heat of the day, and it didn't put a character out of place. The chip still gets quite hot, but not so hot as to be painful to the touch.

So, again I haven't 'repaired' the computer, but merely 'made it work' more or less by accident. I don't know if every other computer repair is done the same way, but does it really matter so long as the equipment is up and running again?

Lunchtime fault

Now we come to a contributed item. It's from the entertaining L.K., of Daintree in North Queensland. As is only to be expected from L.K., this story has an amusing twist to it. It goes like this...

After being in the electronic repair business for more years than I care to admit, the old cliche has a certain ring of truth — I generally HAVE heard them all before. (I often wonder if my doctor has the same feeling!)

And that's the way it was with a VCR which I tackled recently. However, it proved that there is always the chance of a new challenge. This one came with the dubious complaint: "It won't work at lunch time!"

On first reading the job card, I didn't take the statement too seriously, believing that some misinterpretation or communication breakdown had occurred along the way. I proceeded to check the machine over in the normal manner, but after 15 minutes or so of investigation had failed to throw up even a hint of trouble, my eyes were drawn once more to the job card and that tantalizing phrase. It was nearly lunch time. Should I succumb to the temptation?

I carried on with some other jobs and tried poking cassettes into its mouth several times during the 12 — 2pm hours, yet each time it could not be faulted. Alas, there was nothing else for it but to telephone the customer for further details.

I learned that the machine belonged to a businesswoman who received a lot of promotional material on video cassette. To save interrupting her evenings, it was her habit to watch this information during a lunch break, in the undisturbed privacy of her home.

Recently, the offending machine had refused to operate as required, yet was apparently quite satisfactory before and after working hours. She also assured me that it was not a power failure, since the VCR's clock still operated — as did the TV which was connected to the same outlet.

I digested these facts over a tepid cup of coffee. I had to admit that I was indeed confronted with a video which 'would not work at lunch time' — yet it DID work at lunch time for me!

After kicking the problem around over a second cuppa, it seemed reasonable to assume that the fault was temperature related, considering that in this part of Australia at least, the thermometer usually peaks soon after midday.

Also, my workshop is situated on the ground floor of a two-storey concrete building and was, at that particular time of the year, several degrees cooler than ambient — around 26°C. "What's needed", I muttered, reaching under the bench, "is the old hot box".

This is a rather crude yet serviceable contraption, constructed in a hurry some years ago. I have never quite found the time and inclination to update the creation to state-of-the- art! Essentially it is a fencing wire frame bent to resemble the dimensions of a bar fridge and enclosing a small table with legs cut down to around 100mm. Beneath the table are two 100-watt incandescent bulbs, suitably shielded, which plug into a variac.

With the addition of a thermometer and a clear plastic bag cast over the lot, a visually and physically accessible controlled environment is created within, even when the workshop air conditioner is pumping.

And so it came to pass that I had the VCR, covers removed, set up like a premature baby with the temperature slowly rising. All systems were go at 27° and at 28°, but shortly afterwards when I pressed PLAY for the umpteenth time, the thing malfunctioned. More than that, I got lucky as well — which made diagnosis rather straightforward. The tape loading motor had stopped half-way through the loading sequence and for the simple reason, it transpired, that there was no voltage being applied to it.

I didn't have a manual for this particular model (a VC-A101), but it wasn't difficult to trace the motor leads back to the main board, where they eventually wandered around to terminate at IC803 — presumably some form of electronic switch.

I gave this chip a short squirt of 'freeze' and the machine came back to life immediately. Just to be sure, I waited for it to act up again and repeated the exercise, with similar results.

Fault of the Month

Sanyo 79P chassis

SYMPTOM: Severe vertical bounce. At its worst, the picture looks like two flickering images on the screen at the same time.

CURE: C436, a 10uF 16V electrolytic capacitor, was defective. The capacitor is part of a waveshaping network in the feedback line from the vertical yoke windings.

This information is supplied by courtesy of the Tasmanian Branch of The Electronics Technicians' Institute of Australia (TETIA). Contributions should be sent to J. Lawler, 16 Adina Street, Geilston Bay, Tasmania 7015.

The next problem was a replacement part. It was of a type I didn't normally carry in stock, yet I was reluctant to wait until an order came through from the agents. That would mean I would have to set up all the paraphernalia a second time, just to be sure the fault was cured.

A phone call to my 'opposition' bore fruit. Not only could he oblige with a component, but he was about to leave on a service call and would be happy to bring it around to the shop. Even a bit of competition can sometimes have a good side to it!

In the interim I decided to put a thought to the test; one which had been at the bottom of my mind for some time. With the fault still present and the thermometer around 29°, I increased the variac voltage. a few minutes later, as the temperature was going through 31°, the recorder once more returned to normal operation — all by itself!

I repeated this several times and confirmed that this particular failure would show up only between the three-degree range from 28° to 31°. Outside that range it functioned perfectly!

A new IC subsequently fixed the problem, but a couple of interesting points emerged from all this fiddling. Had this set been operated in the more southern latitudes of Australia, where peak temperatures have considerable daily variation, it would have shown up just as an intermittent failure and would have cost a packet in time to track down and repair. In the tropics, where day to day maximums (maxima?) are almost constant, such a complaint as "It won't work at lunch time!" can obviously be quite a realistic statement. I don't always accept the old adage, but in this case the customer WAS right!

Thanks, L.K. As ever, your contribution not only entertains but educates as well. I like the idea of the 'humidicrib' for tracking down thermal faults, and may well devise something similar for use in our colder winter weather.

Fixing a MIG...

Now we come to a new contributor, one B.C. of Mirani, which is also in Queensland. (I didn't chose another banana-bender deliberately, but it does seem that they are the most enthusiastic contributors at the moment!)

B.C. takes us away from the usual run-o'-the-mill subjects and introduces an industrial product that could be a profitable sideline for those prepared to tackle same. Read on...

It really is quite amazing the things that are brought in for fixing when one has the reputation (in my case quite unwarranted) of being able to fix anything.

I was having a quiet beer at the local when a man approached me and asked if I would have a look at his MIG welder. I knew him as a casual acquaintance and, feeling in a benign mood, agreed to 'have a look'!

Although I've heard of MIG welders, I have never seen one and told him so. If the fault was in any way complicated, I would have to bow out. He accepted that condition and we departed to our separate beers.

Nothing happened for a week and I thought that all had been forgotten. Then one day I arrived home to find in my carport the welder on its trolley, a large gas bottle, welding leads and a large coil of cable.

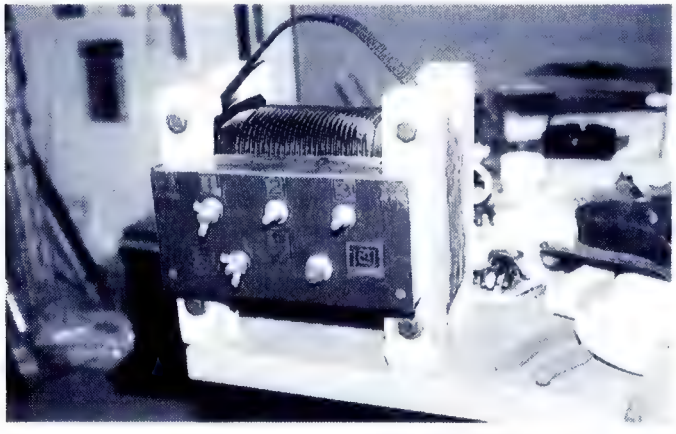
The power cable, all 10 metres of it, looked as though it had been run over by a tram twice a day. So the first thing I did was to test it for continuity. Active and neutral were OK, but the earth lead was open circuit. That's enough to give anyone the shudders... I solved that problem by cutting the lead back to about 30 centimetres and putting a three pin plug on it. That way, it couldn't be run over, although it did necessitate the use of an extension lead. This was more easily replaced if it became damaged.

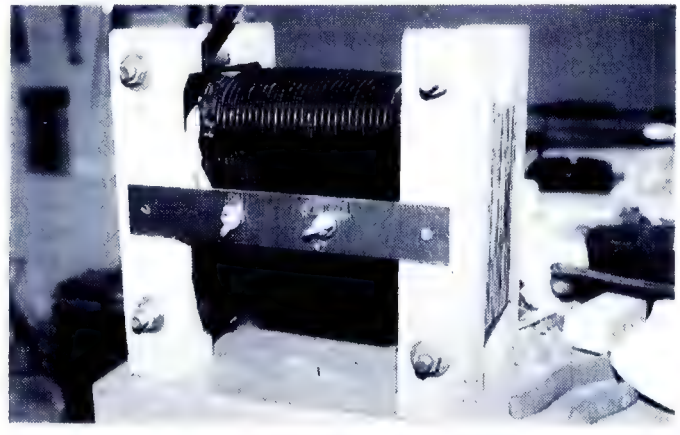
Turning back to the welder itself, I removed one of the side covers. Inside was a transformer (surprisingly small for a welder), a small printed circuit board with a couple of miniature relays, and at the bottom of the case, some hardware that I later found to be a 24-volt transformer and a contactor.

The whole thing seemed to be dead — no hums or rattles. The welding handgrip had a trigger, but operating this had no effect. I verified that there was voltage on the PCB, so I manually engaged the contactor and casually scraped the handgrip over the earth clamp. The resulting flash was quite spectacular and my son, who happened to be watching, later told me that it was the fastest he had ever seen me move! This told me that the transformer and handgrip were functional, so I switched off and resolved to take out the PCB so that I could nut out the circuit and hopefully effect a repair.

The circuit board is about 100mm square and is a complex bit of business. While not 'complicated' in the same sense as a TV or video recorder circuit is complicated, the welder board still has a formidable job to do. For those not familiar with an MIG welder, the machine consists of three basic items: a transformer, a gas supply and a large roll of welding wire.

The welding lead is hollow and the wire and an inert gas are fed to the handgrip through this. The handgrip has a trigger which activates the wire feed motor and a solenoid valve which releases gas into the welding lead. The gas travels up the lead





Reader R.H. of Spit Junction, NSW, sent in these pictures of an arc welder he bought in Hong Kong, during a short stay there. As you can see, it consists of little more than a transformer mounted in a crude wood and bolts frame. Even the mains connections are brought out to a pair of terminal bolts fitted with wing nuts — and not shrouded in any way!!!

and out around the weld, to displace atmospheric oxygen and so prevent oxidation. The circuit also has an adjustable timer which limits the duration of the arc, to allow a uniform series of spot welds.

The PCB looked quite formidable as it had two pots going through to the front panel, and about 12 wires going into what I thought was an insulated terminal strip.

However, when I removed the holding nuts on the pots, the whole board could be pulled back then slipped out of what proved to be a heavy-duty edge connector.

I took the board into my workshop, intending to work out the circuit, but as soon as I began to trace the copper pattern I saw where a section of the track had vapourised — probably due to having been pressed against the fibre insulation and thus overheating.

This particular track went to the edge connector then to a connection marked 'Therm' on the transformer. This is a bimetallic strip which shuts the welder down when it overheats.

I fitted a jumper to the missing track, put everything back together and reassembled the handgrip — which had lost several screws during the owner's attempts to find the trouble. I gave it a try and it seemed to work OK, although the wire feed was a bit jumpy and noisy. But as I had no previous experience with the welder, I had to accept this as normal.

I told the owner all of this and said that he could pick it up at any time. He was delighted with the news, and insisted on paying me about twice what I reckoned the job was worth.

Two days later we met again in the pub. He told me that it was no wonder the wire feed motor was jumpy — it was damaged. By this time I was quite interested in the whole job, so I suggested that he bring the motor in to let me have a look at it.

Damaged motor

It was a small permanent magnet motor, a bit smaller than a stubby holder (seeing that we were still in the pub!) and it had been taken apart. When I looked inside, I could see only one pole magnet. The other one was in the owner's hand, broken into four pieces.

The motor had no identification, apart from the brand name 'Electrolux' stamped into the case of the worm drive. I said I'd see what I could do, but when I took it around the electrical repair firms in Mackay, all I got was a shake of the head.

After giving the matter some thought, I decided to try to glue the pieces together. This is easier said than done, since the pieces are all 'like poles' and repel each other quite strongly. After 20 minutes or so I was covered in Araldite and still hadn't had any success.

I called my wife in to help and when she got covered in Araldite too, I decided to call it a day. I thought about it overnight and toyed with the idea of drilling the pieces and bolting them into place. Then, a fairly obvious idea came up.

Why not glue each piece into place separately? The small pieces repelled each other much less actively when handled only two at a time. Of course, it took much longer to complete the job — it was something like five days before I could reassemble the motor and try it out. It purred like a kitten.

I asked the owner to bring the welder in, minus the gas bottle, so that I could reassemble it. Once again the welder materialised in the carport. I replaced the motor, switched on and pressed the wire feed trigger. Nothing!

By this time I was getting pretty familiar with the internal arrangement, so I took the cover off the feed relay and operated it manually. The feed motor worked perfectly. An ohmmeter test revealed that the relay coil was open circuit. Of course, there was nothing like it available locally, but Altronics had the identical relay in their catalogue. It took a few days to get a replacement and on installing it, the whole machine worked perfectly.

After all this I got pretty friendly with the owner and we discussed the damaged motor. It seems he loaned the welder to a 'friend' and when the feed motor wouldn't work, the friend took the covers off to have a look. The friend further alleges that his two young nephews got 'stuck into' the motor with a hammer while he was briefly absent — you can still see the hammer marks on the motor. But I really wonder if the friend himself was not trying to start the motor with the hammer?

All that was over a year ago and the machine is still working perfectly. The owner was so pleased that he insisted on giving me more money — pity there aren't more like him!

Thanks, B.C. You've introduced another interesting topic to the Serviceman pages. And while we are on the subject of welders, you might be interested in this short item from another reader. It came in the form of a personal letter from R.H. of Spit Junction, NSW.

Safety last?

It seems that R.H. had a contract to do some work in Hong Kong and considered taking his tools with him. However, one essential tool was an arc welding kit and the cost of freighting that to and from HK would be prohibitive.

So he decided to wait until he got there, and then buy the cheapest welder that would do the job. He would sell it on his departure, or even abandon it rather than pay freight to bring it back to Australia.

I am assured that the photos opposite are an un-retouched representation of the welder he bought from a welding supplies company in Hong Kong. In other words, it is a commercial product, on open sale over there!

He comments that he found the Hong Kong Chinese very strange people to work with. They seem to have no care for safety in anything they do. This transformer is a case in point.

The two wingnuts seen on the side panel are for the connection of 240V mains. There is no case, no shroud over the mains terminals, no protection of any kind. Can you imagine something this crude being allowed on sale here?

His letter does not say how much he paid for the welder, but it does imply that he had no qualms about leaving it behind when he left!

That's all for this month. See you again next time? ❖

WHAT'S ALL THIS HAM RADIO STUFF?

We have it on good authority that shortly after you read this, the Department of Transport and Communications will at last announce wide-ranging revisions to the regulations governing amateur radio operation in Australia. Designed to remove many of the former restrictions, the new regulations are expected to add greatly to the appeal of amateur radio and the enjoyment to be gained from it. Here's a quick rundown...

by TOM MOFFAT, VK7TM

Well, they're about to do it — zap the Morse code! In a few weeks now it'll be possible to get an amateur radio licence without battling your way through a sea of dots and dashes. Under the new regulations, you'll only need to do a simple examination of basic radio theory and some easy-to-understand regulations.

I'm told by the radio authorities that the exam is along the lines of the Restricted Radiotelephone Operator's Permit required for people who operate marine radios. If a bunch of non-technical yachties and fishermen can pass such a test, so can you. After a few short hours' study, you'll hose it in!

What you'll end up with is a Novice Limited Class licence, which will let you operate on the VHF (144MHz) and UHF (432MHz) ham bands. In ham jargon, these are usually referred to as the two-metre and 70-centimetre bands. Operation on these frequencies nowadays is almost entirely on FM, although some enthusiastic experimenters still press the frontiers of technology with single-sideband and Morse code communications in the lower portions of the bands. These are the people who sling signals across continents and bounce them off the moon.

Although it's not clear at the time of writing, it's likely that with your no-code ham licence you will be limited to FM only. But FM will keep you contented for a long time, as you explore such things as packet radio and fancy antenna experiments, working the 'skip'.

I fell hook, line, and sinker for ham radio many years ago in the USA, after a quirky experience with VHF-FM. Back then I was working for the Bell Telephone Company, maintaining repeater stations on mountaintops and in the deserts in Nevada.

Since I worked alone I always carried a portable FM radio for company. It was kept tuned to a Reno FM station, which produced good strong signals over a large part of the state from the top of a 9000 foot mountain. But one day, for some reason, I started fiddling with the tuning.

As I moved along the dial, all these strange stations kept popping up — ones I'd never heard before. And when they identified themselves, they mentioned such places as Chicago and Philadelphia and some Canadian cities, thousands of kilometres away. Wow! That was *skip* with a vengeance, and when I got back to home base that night I found that a couple of radio ham workmates had spent the afternoon sitting in their personal cars, working all over the country from their two-metre VHF mobiles.

In theory, what had happened that day was impossible, since VHF signals are supposedly limited to line-of-sight paths only, like that FM station on the top of Slide Mountain. But when unusual ionospheric or atmospheric conditions develop, anything can happen. I suddenly realized that there was a lot of fun to be had fiddling around with VHF radios, and I immediately started working for my ham licence.

Weird radio conditions are fairly common in Australia, and many times I've heard VHF signals coming from 'impossible' places. Once on a camping trip on Tasmania's Central Plateau, I spent the evening with a little Walkman-style FM radio listening to the commercial broadcasters in Melbourne and Sydney — obviously due to some kind of 'ducting' effect over Bass Strait.

On another bushwalking trip, standing on top of Cradle Mountain, I was able to talk with amateur stations in Adelaide and Melbourne via VHF repeaters in those cities. And the strangest of all:

Handheld VHF/UHF FM transceivers make an excellent choice for the newcomer to amateur radio. Here are three examples of the latest models. At lower left is Kenwood's TH-28A, with Icom's IC-2SRA in the centre and at right Yaesu's new FT-530. Both the Icom and Yaesu models operate on two bands simultaneously — the 144MHz or '2-metre' band and the 432MHz or '73cm' band.

using a VHF walkie-talkie with half a watt output, standing on a beach in southern Tasmania, I held a long conversation with another amateur using a similar radio, standing outside his house in Sunbury, Victoria. Direct communications between little hand-held radios is usually over a few kilometres, not a few HUNDRED kilometres!

As an electronics enthusiast you can *listen in* on these activities, of course — but with the new no-code ham licence, you'll be able to *take part* in them. And if you've got enough smarts to understand the articles in this magazine, then you've probably already got the technical knowledge for the Novice Limited licence. As for the regulations part, most of that is commonsense, like the requirement not to interfere with emergency communications.

Working skip (DX in ham jargon) is the icing on the cake of day-to-day VHF activity. More routine contacts are across town, often through repeater stations on top of mountains or high buildings. With a repeater you can use a tiny walkie-talkie to communicate with a similar radio over 100km away, with complete reliability.

Much two-metre operation is from cars, and in the bigger cities there is always a large group of stations yakking away during the morning and evening drive times. An individual ham may be alone in his car, but he's still got a dozen mates to talk to as he cools his heels in the traffic jams. A visitor to a strange city may call on the repeater and suddenly find he's got a dozen friends too, all with local knowledge. Some of the people I first met on two metres have become life-long friends.

The UHF (70cm) band uses much the same technology as the two metre band, but on frequencies three times as high. You can tell a UHF radio by its antenna, which will be only a third the size of a VHF equivalent. Skip is rare on UHF, although it does happen. In theory the range of UHF is shorter than VHF, but within that shorter range the signals tend to penetrate obstructions and saturate the area more fully.

Inner city areas in particular show the most benefits from UHF, compared with VHF. Police and other emergency services are constantly moving toward UHF, and of course those handy little cellular mobile phones are on frequencies twice as high again as the 70cm amateur band. Many readers will already have some UHF experience via the UHF-CB band.

There are now many UHF amateur repeaters, perhaps rivalling the popularity of their two-metre cousins. Two-metre repeaters have been around for over 20 years, but UHF came on the scene much later. Consequently many of the UHF systems are newer, with more modern facilities, and they usually appear more 'civilised' to the user in terms of blanket coverage and the quality of their signals. Many of these repeaters are top grade ex-commercial units with names like Motorola and AWA, which would have cost thousands of dollars new.

Why not just stick with UHF-CB, you say? Well, the people you will talk with on the UHF amateur band will be much more technically orientated than those on CB. And you will not be fighting for channel space with Joe's Plumbing Service, since commercial operation is forbidden on amateur frequencies.

There is a very good chance that UHF-CB as we know it will dissolve into a shambles. I understand the CB service is to be totally deregulated, so that no operator licence whatsoever will be required. So the CB service could very well end up a high-profanity shouting match. The VHF/UHF amateur bands will be a welcome refuge for 'serious' CB'ers.

Many CB'ers have already ground their way through five word-a-minute Morse code to qualify for Novice amateur licenses. A few years ago the regulations were changed to allow Novices to use part of the two-metre band, so we wound up with many former and current CB'ers on two metres. Despite bitter protests from some of the old-time hams, the new blood from CB has livened up the two-metre band no end. I'm sure present hams will welcome new Novice Limited's with open arms!

Of course you must have radio equipment to make use of your new Novice Limited licence. Years ago we used to modify old commercial sets, or we even built them from scratch. Nowadays FM equipment is almost always bought as ready-to-go amateur gear from companies like Icom, Kenwood, Yaesu, and several others. Although 'base station' equipment is available, most commercially made VHF/UHF amateur gear is designed either as a car mobile, or a hand held walkie-talkie.

Any mobile can also be used as a base station (in your home, connected to a large outdoor antenna) by simply connecting it to a 12-volt DC power supply running from the mains. For lower

New regs 'real soon now'

Bill Roper VK3ARZ, who is general manager of the WIA, advises that the new Amateur Regulations are expected to be finalised and announced within the next two months.

This was conveyed in a letter from the Assistant Secretary of The Department of Transport and Communications, Radiocommunications Operations Branch, Gwen Andrews, who wrote to Bill on the 1st of February. Apparently things have been delayed by the planning and organisation for the new Spectrum Management Agency (SMA), which must be ready by July 1, in order to meet the requirements of the new Radiocommunications Act passed by Federal Parliament in November last year.

In her letter, Gwen Andrews indicates that the final proposals on the new Amateur Regulations were being reviewed by senior management at the time of writing. It now seems unlikely that they will be announced before July 1, but Ms Andrews said that as the proposals represent a significant deregulation of the Amateur Service, they will presumably be worth waiting for.

powered radios, CB-type power supplies work nicely. In my own instance I have two mounting brackets for my mobile, one bracket in the car and the other screwed to the bench in my workshop. The radio can be swapped from one location to the other in a couple of minutes.

As things stand now, if I were just starting out with my new ham licence, my first radio would be a combined VHF/UHF walkie-talkie. With a base-station type unit, you must sit at an 'operating position' in order to use the radio. With a hand walkie-talkie you can sit anywhere you want, in a lounge chair inside, or on the grass outside. You can use the radio in one hand while stirring your dinner with the other. I've even used mine sitting on the loo, and I'll bet lots of other people have too.

Handheld radios generally have maximum transmitter powers of between one and five watts. There is usually a switch to reduce them to 500 milliwatts, or 100mW, or on the latest Icom, 25mW. Even this scrawny power is enough to work into the main Hobart two metre repeater from my home. With walkie talkies, big power means big battery drain. From experience I've found that low power does just about everything that high power does, and the battery lasts two or three times longer.

Mobile sets can have as little as 10, and as much as 50 watts output. Again, power output affects battery drain, although as long as you're moving the battery is being charged. Of more concern is the heat generated by a powerful radio. In a warm climate this could cause reliability problems. A 25-watt radio will be plenty to work directly from car to car, right across a city. Most mobiles have low-power switches. Note that regulations in some states forbid the use of hand microphones in moving vehicles, but you can overcome this with various boom mounted microphones or headset devices.

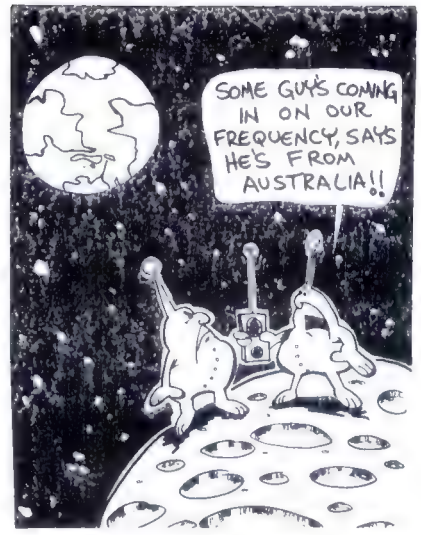
You should really get a combined VHF and UHF radio if possible. Each band has its own advantages and disadvantages, and most areas that have two-metre repeaters also have 70cm repeaters, sometimes sharing the same mountaintop. The cheapest single-band radios start at less than $300 while the latest combined VHF/UHF sets can cost well over the thousand mark. Don't forget used gear; as an example, I recently sold a tiny Icom VHF walkie-talkie to a ham mate down the road for $250. Look around and you should find similar deals.

(Editor's note: Don't forget kits, either — these can be a rewarding and satisfying way to save money on amateur gear. For example Dick Smith Electronics has a 25W/5W FM Transceiver kit for the 2m band, priced at only $399.)

Packet radio

Packet radio is a method of interconnecting computers over the air. It's much like the telephone-based bulletin board systems, only it's free. As well, since no wires are required, you can connect with the packet radio network from just about anywhere using a battery powered laptop computer, a handheld walkie-talkie radio, and a suitable interface between the two.

To use packet radio you fire up your FM radio on a particular frequency, usually 147.575MHz, and then instruct the computer to 'connect' with the desired station. The station may be another one just like yours, worked either with or without the help of a



mountaintop repeater. Or it may be a 'bulletin board', which looks for all practical purposes just like a bulletin board you would dial up on the phone. Once 'connected' you can type back and forth with the other station, just as if you had a private line.

It is also possible to upload or download files, be they text files or computer programs. I use packet radio regularly to download the latest orbital data files for weather satellite tracking. The information is posted on the system from NASA in Washington DC in the USA, less than 24 hours before it lands on my local packet bulletin board here in Tasmania.

Once connected to a packet bulletin board, you can launch or retrieve written messages to or from any other packet radio station anywhere in the world. And messages aren't just of a technical or radio nature. For instance, during a recent 'connect' to the main Hobart packet bulletin board, I found a message to ALL USERS from a fellow in England who was trying to determine the origin of the name DUKW which was applied to army amphibious landing craft. These vehicles were used in the Antarctic to transfer people and equipment from the ships to the bases ashore. I looked for a reference to 'DUKW' in some of my own Antarctic literature, to no avail. Had I found it I could have launched a message right back to the fellow, all the way to the UK, for no cost at all.

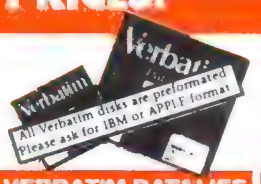
The packet radio network is growing enormously; packet operation looks like becoming THE most popular operating mode anywhere, and we are indeed fortunate in Australia that the easiest grade of licence class allows us access to this fascinating radio network.

What you see here is just the briefest

Continued on page 81

A way of getting into amateur radio at low cost is to assemble your own transceiver kit. This 2m FM transceiver kit is available from Dick Smith Electronics, for $399 — but this does not include the microphone.

5.25" from 39¢ CHEAP BULK DISK PRICES!



NO BRAND DISKS

ALL DISKS INCLUDE WRITE PROTECTS & ENVELOPES
BOXES OF TEN DISKS LIFETIME WARRANTY

	1-9+	10+	50+	100+	500+
5 1/4" DS/DD	$4.95	$4.60	$4.40	$4.20	$3.95
5 1/4" DS/HD	$8.95	$8.25	$8.10	$7.95	$7.50
3 1/2" DS/DD	$8.95	$8.25	$8.10	$7.95	$7.50
3 1/2" DS/HD	$13.95	$13.50	$12.50	$9.90	$9.00

MEMOREX DISKS

	1-9 boxes	10+
3 1/2"DD	$19.95	$18.95
3 1/2"HD	$45.95	$42.95
5 1/4"DD	$14.95	$12.95
5 1/4"HD	$23.95	$22.95

VERBATIM DATALIFE

	1-9 boxes	10+
3 1/2"DD	$21.95	$20.95
3 1/2"HD	$42.95	$41.00
5 1/4"DD	$17.95	$16.95
5 1/4"HD	$22.95	$21.95

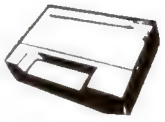
VERBATIM VALUELIFE

	1-9 boxes	10+
3 1/2"DD	$19.95	$18.95
3 1/2"HD	$34.95	$32.95
5 1/4"DD	$10.95	$9.95
5 1/4"HD	$15.95	$14.95

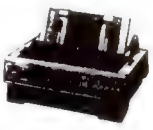
YOU'LL HAVE TO GO A LONG WAY TO FIND DISK PRICES LIKE THESE

SAVE ON OUR GREAT RANGE OF EPSON PRINTER

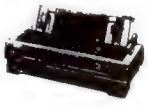
LX-400 80 Col, 9 Pin Dot Matrix, 180 Cps Draft 30 Cps NLQ, Pull Tractor
C22054..... $249



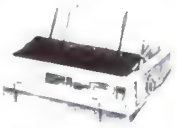
LQ-100 80 Col, 24 Pin Dot Matrix 200 Cps Draft, 72 LQ, Built in sheet, feeder 8 fonts. 2 scalable fonts
C22070..... $429



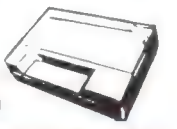
LQ-870 80 Col, 24 Pin Dot Matrix,330 Cps Draft, 110 Cps NLQ, Scalable Fonts, 8 to 32 points, 11LQ Fonts , 360 x 360 DPI, Top, Rear, Bottom, & Front paper Feed paths Convertable Push/Pull Tractor.
C22072..... $950



LQ-1070 136 Col, 24 Pin Dot Matrix, 252 Cps Draft., 84 Cps NLQ, Scalable Fonts, 8 to 32 point, 11 LQ Fonts, 360 x 360 DPI, Top, Rear, Bottom, and Front Paper Feedpaths, Convertable Push/Pull Tractor
C22066..... $795



LQ-570 80 Col, 24 Pin Dot Matrix, 252 Cps Draft, 84 Cps, NLQ Scalable Fonts 8 to 32 points, 11 LQ Fonts 360 x 360 DPI, Top, Rear, Bottom and Front paper feed paths, Convertable Push/Pull Tractor.
C22068..... $579



LX-100 80 Col, 9 pin Dot Matrix, 240cps Draft, 48 cps NLQ, 3 fonts, 50 sheet paper cassette Standard Push Tractor with SmartPark.
..... $369

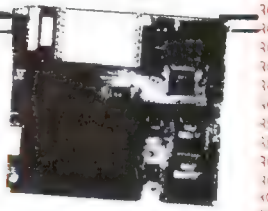
NEC PINWRITER P3200

Features:
- Built in tractor - Versitile Paper Handling
- Fully Function Operator Panel - easy to Operate
- 7 Resident Typestyles - Executive Print Quality
- 216 CPS - faster Speed and Throughput
- Pinwriter Emulation - Compatibility with Virtually all PC Software.
- Compact Design - Fits easily on your Desktop
- The P3200 has a heat sensor to guard against overheating.

C93270.....$477.00

MS DOS 6.0

UPGRADE 3.5" OR 5.25" just $89.00



386/486 MULTIBOARD WITH 386-40 PROCESSOR FITTED

The OPTI-495SX 3/486WB Cache motherboard is a low cost 3 chip solution offering optimal performance for low to Mid range 386/486 Cache base AT sysytem. The OPTI-495SX 3/486WB Cache M/B is designed for 386 systems running from 25 33 and 50MHz It supports 386DX, 486SX, 486DX 486DX2 and one 32 Bit local Bus.
The OPTI-495SX 3/486WB Cache motherboard also has an option to accomodate either 64K, 128K, 256K, of external Cache and support the 80387 numerical Co-processor. Because of it's unique memory subsystem design, the OPTI-495SX 3/486WB Cache M/B allows for 1 Megabyte to 32 Megabytes of 32-bit high speed memory by using 256K, 1M amd 4M SIMM modules.
Cat No.
X18117.....$399.00
Rod Irving Electronics now provides a motherboard that works around the pinout problems with jumpers that allow you to start off with a bare motherboard and install whatever CPU you wish to use (386 or 486). So therfore just by changing your CPU at a later date you can upgrade your system.

Local Bus VESA 1 MEG VGA card to suit above multiboard....$299

IBM CARDS

NEW LOCAL BUS VESA CARD	$299
PRINTER CARD	$29
2 PORT SERIAL CARD	$39
GAMES CARD	$29
CLOCK CARD	$39
512/576K RAM CARD OK RAM	$69
2 WAY FDD CONT.	$89
4 WAY FDD CONT.	$129
VGA 16 BIT 256K	$59
VGA 16 BIT 512K	$79
VGA 16 BIT 1 MEG TRIDENT	$149
VGA 16 BIT 1MEG TSENG LAB	$285
16M HD CACHE CARD OK RAM	$495
HDD IDE /FDD 24MHz	$29
HDD IDE/FDD/SPG	$39
8 BIT ETHERNET CARD	$235
16 BIT ETHERNET CARD	$285
AT HD CONTROLLER	$149
AT SPG CARD	$39
MULTI I/O CARD	$99
MONO COLOUR CARD	$69
EGA CARD	$99
DIAGNOSTIC CARD	$795
TTL PRINTER CARD	$79
FAX CARD	$595
6M AT EX/EXP	$225
PARADISE ACCELERATOR	$229
PARAKEET ACCELERATOR	$219
MFM HDD CONTROLLER CARD	$149
SIRIUS ACCELERATOR 1 MEG	$199

HARD DRIVE SPECIALS

PRICES ARE WITHOUT PADDLE CARDS & BRACKETS
2 YEAR WARRANTY ON VOICE COILS

40M SEAGATE DRIVE	$279
85M HD 6ms T.T ACCESS. VOICE COIL	$369
105M HD 6ms T.T ACCESS	$379
131M HD 6ms T.T ACCESS. VOICE COIL	$389
170M 6ms T.T ACCESS. VOICE COIL	$449
212M HD 5ms T.T ACCESS. VOICE COIL	$499
255M HD 5ms T.T ACCESS. VOICE COIL	$649
345M H.D 5ms T.T ACCESS. VOICE COIL	$795
450M H.D 10ms. avg ACCESS TIME	$995
528M HD 5ms T.T ACCESS VOICE COIL	$2295

MEMORY

MEMORY	1-9	10-99	100 +
41256-08	$2.95	$2.75	$2.50
44256-07	$7.95	$7.50	$6.50

SIMMS	1-9	10-24	25+	100+
256K-60	$29	$27	$26	$25
256K-70	$23	$21	$19	$17
256K-80	$21	$19	$17	$15
1M x 9-70	$67	$64	$62	$60
1M x 9-60	$69	$66	$64	$62
4M x 9-70	$235	$229	$249	$219
4M x 9-60	$369	$359	$349	$3290

72 PIN RAM MODULES
4 MEG RAM...$279.00
8 MEG RAM....$549.00 16 MEG RAM....$1,049.00

WARNING RAM prices are rising soon!

MOTHERBOARDS

386SX-33/41	$179.00
386-40 128K CACHE	$349.00
386-40 128 Cache withUpgradable CPU socket & Local BusSlot	$499.00
486SX-33 256K Cache	$695.00
486-33 256K CACHE	$795.00
486-33 256K CACHE 3 Local Bus Slots	$1395.00
486-50 256K CACHE	$1095.00
486-66 256K CACHE	$1395.00
486-33 EISA	$1995.00
486-50 EISA	$2295.00

WHO HAS THE LATEST TECHNOLOGY?.....WE DO MATE!

MONITOR SPECIALS

SUPA VGA COLOUR MONITOR "3 YEAR WARRANTY"
This stylish and reliable monitor has been designed for Australian conditions & comes with a 3 year warranty.
SPECS: cte: 14" 90° deflection, dark tint, non-glare.
Display size: 245+/5mm x 180+/-5mm x 180+/-5mm
Resolution: (max): 1024 x 768.
only $449.00

SUPER VGA MULTISCAN NEC COLOUR MONITOR 0.28" D.P NON-INTERLACED 1024 x 768...$499.00
As Above: with Low Radiation EMC..$549.00

MORE HANDY PRODUCTS FROM ROD IRVING ELECTRONICS

ROD IRVING ELECTRONICS MAIL ORDER HOTLINE: 008 33 5757

STROBES

VISIBLE ALARMS ARE BETTER DETERENTS

Xenon strobe flash with screw mounting base. Useful for mounting on or next to alarm sirens etc. for added security.
Connections are made through the base so all wires are hidden.
- Flash rate: 120 per minute.
- Operating voltage12VDC.
- Current draw: 150mA
- Dimensions : 90 (dia) x 105(H)mm

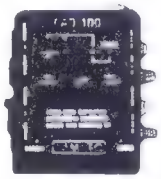
A15044 BLUE
A15047 RED.....$37.95

ATTRACTS INSTANT ATTENTION

ROTATING WARNING LIGHT-BLUE

Motor driven rotating reflecting mirror with large waterproof lens ensures this will be seen in emergency or alarm situations. Wire connections are made through the base so all wires are hidden.
- Rotates 150 times per minute.
- Shock absorbing rubber mount legs.
- Operatng Voltage: 12VDC,
- Current draw: 750mA
- Dimensions 102(dia) x 140(H)mm

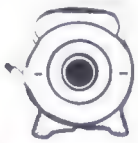
A15042.....$49.95



CABLE AND LEAD TESTER

Designed to test balanced and unbalanced cables with three pin XLR connectors as well as leads with 6.5mm phone or RCA plugs. Ideal for checking patch leads and long cable runs before they can damage equipment. Operates wih a single 9 volt internally mounted battery and utilizes easy to read LED's for quick readings whilst out on the job.
A10532.....$50.00

TAKE THE TV OUTSIDE BY THE B.B.Q.



EXTENTION 75OHM FLYLEAD-10M

Here's how to get your TV out on the back patio or out by the pool. Simply Unwind the ten metre extention lead from its handy dispenser and extend your antenna to where ever you want to go. Colour White
P32180.....$29.95

ANTENNAS

KEY LOCKDOWN ANTENNA

- 4 Sections
- 860mm long extended
- 1.2metre lead with plug

A12061.....$8.95

ANTENNA WITH SPRING BASE

- Three sections
- 1.4 metre long exteded
- 1.2 metre lead with plug

A12062.....$18.95

TOP COWL ANTENNA

- Single section
- 1 Metre long extended
- 1 metre lead with plug

A12068.....$9.95

PILLAR MOUNT

- Suits Mazda, Nissan, and Toyota.
- 1.2 metre long extended
- 1.2 metre lead with plug

A12064.....$8.95

RUBBER DUCKIE

Black flexible rubberised antenna for the car, truck or boat. Flexability prevents damage from low trees.
- Single Section
- Conductive Rubber body
- Bonnet or boot mount
- 400mm long
- 1.2 metre lead with plug.

A12066.....$12.95

UNIVERSIAL CAR MOUNTING BRACKET KIT

Contains three pairs of different sized mounting brackets for car stereos CB's and other communication equipment in the car or truck etc.
- Includes support/earthing strip.
- Hardware supplied nuts, bolts, screws lockwashers.

H28615.....$8.95

STOP START MICROPHONE

With on/off switch & separate control lead for remote operation of the cassette player. Complete with desk stand for hands free operation.
A10126.....$5.95

DC POWER LEADS

DC TO DC POWER LEADS

2 metre DC Power Lead with inline 5 amp fuse - Black.
- Input: Car Cigarette lighter plug
- Output: 2.1/2.5/3.1mm DC or 2.5/3.5mm phone plugs

M19023.....$12.95

DC TO DC POWER LEADS

1.6 metre DC Power lead-Black.
- Input: Car cigarette lighter plug with fuse
- Output 21/2.5mm DC or 2.5/3.5mm phone plug.

M19022.....$7.95

TOOLS

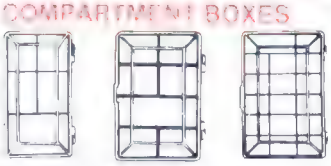
TORX SCREWDRIVER

Torx Screwdriver with "T" shaped handle. Size: 1.5
Length: 150mm
T12104.....$2.95

COMPONENT RETRIEVAL PAGE

Supplied with 2 fully insulated tweezers and a long flexible finger with a magnet on the end. Allows small components and objects to be picked up or manipulated in small, narrow hard-to-get-at places.
T12084.....$11.95

COMPARTMENT BOXES



Ideal for electronic components, parts and other storage applications,
- Each is made robust opaque plastic
- Hinged "snap locking " lid.

FIVE COMPARTMENT PARTS BOX

One large & four small individual sections H10088.....$5.00

SEVEN COMPATMENT PARTS BOX

One large and Six small individual sections H10089.....$6.00

SEVENTEEN COMPARTMENT PART

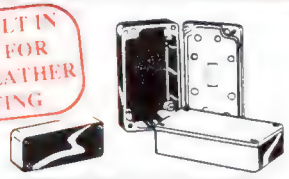
BOX - One large and 16 small sections
H10090.....$9.00

TWENTY-SIX COMPARTMENT PARTS

BOX-Twenty six storage sections
HIOO92.....$9.55

A NEW SHIPMENT OF CASES HAVE JUST ARRIVED. AT EVEN LOWER PRICES!

WITH BUILT IN GASKET FOR TOTAL WEATHER PROOFING



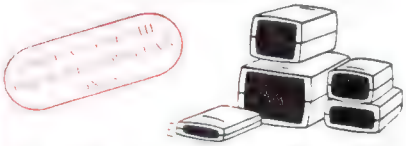
NEW DIECAST BOXES

		1-9	10+
H30000	90x36x30mm	$6.75	$5.95
H30010	64x58x35mm	$6.95	$6.25
H30020	115x65x30mm	$8.95	$7.50
H30030	115x65x55mm	$12.95	$11.50
H30040	115x90x55mm	$14.50	$12.95
H30050	148x108x75mm	$27.50	$24.50
H30060	171x121x55mm	$27.95	$24.95
H30070	222x146x55mm	$28.95	$25.95

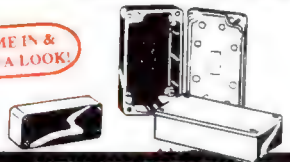
GREAT VALUE! COMES WITH BUILT IN RUBBER GASKET AND WEATHER PROOFING

NEW SEALED POLYCARBONATE ENCLOSURES

		1-9	10+
H30200	64x58x35mm	$4.95	$4.50
H30210	115x65x40mm	$6.95	$5.95
H30220	115x65x55mm	$8.95	$7.95
H30230	115x90x55mm	$11.95	$9.95
H30240	117x121x55mm	$19.95	$17.95
H30250	222x146x55mm	$24.95	$22.95



COME IN & HAVE A LOOK!



NEW INSTRUMENT CASES

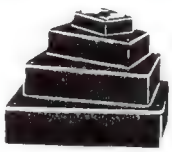
		1-9	10+
H30300	90x15x16mm	$2.95	$2.65
H30305	90x50x24mm	$3.95	$3.50
H30310	90x50x32mm	$4.95	$4.25
H30315	120x60x30mm	$5.50	$4.50
H30320	120x60x40mm	$6.50	$6.25
H30325	120x60x50mm	$6.95	$5.95
H30330	150x80x30mm	$7.50	$6.50
H30335	150x80x45mm	$8.50	$7.50
H30340	150x80x60mm	$9.95	$8.50
H30345	190x100x40mm	$10.95	$8.95
H30350	190x100x60mm	$12.95	$10.95
H30355	190x100x80mm	$14.95	$12.95

NEW WATERPROOF CLEAR TOP POLYCARBONATE INSTRUMENT BOXES

		1-9	10+
H30100	64x58x35mm	$8.95	$7.95
H30110	115x65x40mm	$11.95	$9.95
H30120	115x65x55mm	$12.95	$10.95
H30130	115x90x55mm	$14.95	$12.95
H30140	171x121x55mm	$20.95	$18.95
H30150	222x146x55mm	$24.95	$21.95

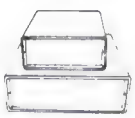
WHO CATERS FOR ALL YOUR ELECTRONIC NEEDS?....WE DO MATE!

PLASTIC BOXES



Plastic boxes with plastic lids.
Comes with 4 screws
Black in colour.
H10128 83 x 54 x 28mm..... $1.95
H10126 130 x 68 x 41mm....$2.50
H10122 150 x 90 x 50mm...$3.95
H10124 195 x 113 x 60mm..$4.95

NEW CASES



Beige plastic moulded cases with aluminium end panels

160mm (W) x 55mm (H) x 170mm (D). H10204.....$22.95
110mm (W) x 46mm (H) x 146mm (D). H10202.....$18.95

EPROM SPECIALS

	1-9	10-25	25+
27C64-20	$4.50	$3.90	$3.50
27C256-20	$5.00	$5.00	$4.50
27C512-15	$6.00	$5.50	$5.00

EPROM ERASER With Timer

Sure it erases your EPROM's quickley and safely and will erase up to 9 x 42 pin devices in about 40 minutes. (less for less chips). But with this one you don't have to waste your time standing around waiting for them. The EPROM has a timer which allows you to "set and forget". By using the timer function it not only saves you money by reusing your EPROM's but you also save presious time doing other jobs while the eraser is working. And you'll never have to worry about turning it off and "cooking" your EPROM's. Choose from a wide range of different settings from 15 minutes to 40 minutesdepending on the intensity of the UV source.
*The chip door has a conductive foam pad.
*High intensity at the chips surface ensures EPROM's are thoroughly erased.
*Engineered to prevent UV exposure.
X14955
SAVE $40 NOW JUST $129.00
X14950
WITHOUT TIMER
Was $109.00 Now just $89.00
Spare UV tube for Eraser
X14957.....$14.95

BNC CONNECTORS

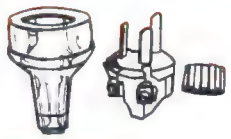
BNC JACK TO BNC PLUG "L" TYPE.
Great for Network cards at the back of computers.
P10526.....$6.95

BNC FEMALE LINE JACK TO SUIT RG5
P10535.....$2.95

MIC 3 PIN LINE SOCKET
P10280 .....$6.95

BNC "T" ADAPTOR
P10517.....$6.95

NEW ELECTRICAL PRODUCTS



CLIPSAL 3 PIN PLUG

With transparent cover for instant visual safety check for connections.
Recomended for 0.75mm2 and 1mm2 Ordinary Duty.
Three Core Flexible Cords.
250V 10A
P18003.....$2.95

LUG MOUNTING (RG) CAPACITORS

BACK IN STOCK

			1 - 9	10 +
R16585	8,000uF	75V.....	$12.95	$10.95
R16587	10,000uF	75V.....	$14.95	$12.95

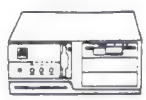
FOUR OUTLET POWER POINT

250 VOLT 10 AMP (TOTAL LOAD)
P18054.....$39.95

CASES

Case styles will vary from illustrations

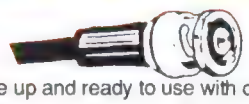
MINI FLIP TOP TOWER CASE with POWER SUPPY..$99.00



FLIP TOP CASE with POWER SUPPLY..$79.00

TOWER CASE with POWER SUPPLY
$250.00

ETHERNET CABLES



Made up and ready to use with connectors
2M 50ohm cable $11.95
3M 50ohm cable $13.95
5M 50ohm cable $18.95
10M 50ohm cable..... $27.95
20M 50ohm cable..... $39.95

BOX HILL STORE
NOW OPEN
1031 MAROONDAH HWY. BOX HILL
(opposite BoxHill town hall)
Ph: (03) 899 6033 FAX: (03) 899 0156

DISCOUNT COMPONENTS

XENON/STROBE TUBES

As used in projects or as replacement.

S14050.....$3.95

CHROME LED BEZELS

9 mm hole, available 3 colours

S14030 Red.....$1.20
S14032 Green.....$1.45
S14034 Yellow....$1.45

GREY FLAT RIBBON CABLE

cat no.		$/Mtr
W12614	14way	$1.90
W12616	16way	$2.20
W12620	20way	$2.50
W12624	24way	$2.90
W12625	25way	$3.20
W12626	26way	$3.60
W12634	34way	$3.90
W12636	36way	$3.90
W12640	40way	$4.90
W12650	50way	$5.90
W12660	60way	$6.90

10 TURN WIRE WOUND POTENTIOMETER

Spectrol Model 5341/4" shaft. Equivalent (Bourns 3540S Beckman 7256) Dials to suit 16-1-11, 18-1-11, 21-1-11.

R14050 50R R14100 5K
R14055 100R R14110 10K
R14060 200R R14120 20K
R14070 500R R14080 1K
R14090 2K

1-9	10+
$12.95	$10.90

R14130 50K.....$16.95
R14140 100K.....$15.95

NUMERIC KEYPAD

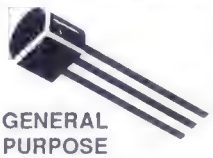
These are ideal for telephone dial projects or security systems. 4 x 3 encoded keypad. 10 digits with 2 utility keys. Black in colour

S13062.....$7.95

DIE CAST BOXES

Diecast boxes are excellent for RF sheildingand strength. Screws are provided with each box.

H11451
100 x 50 x 25mm.....$8.95
H11452
110 x 60 x 30mm.....$9.50
H11453
120 x 65 x 40mm.....$10.50
H11461
120 x 94 x 53mm.....$13.95
H11462
188 x 120 x 78mm....$15.95
H11464
188 x 188 x 64mm....$29.50



GENERAL PURPOSE TRANSISTORS

PN100: a NPN general purpose medium power amp and switch with continuous collector current up to 500mA. PN200: a PNP general purpose amp at collector currents to 1 AMP. Both are TO-92 plastic package.

PN100 REPLACES:

PN2221, PN2222, PN2222A, PN3585, PN3568, PN3569, PN3643, PN5133, 2N2219A, 2N2222A, 2N3414, 2N3415, 2N3416, 2N3417, 2N3700, 2N3704, 2N3904, 2N4123, 2N4124, 2N4401, 2N5088, 2N5210.

PN200 REPLACES:

PN2907, PN2907A, PN3638, PN3638A, PN3640, PN3644, PN4121, PN4143, PN4248, PN4249, PN4250, PN4355, PN4916, PN4917, PN5910, 2N2905A, 2N3467, 2N3702, 2N3906, 2N4125, 2N4126, 2N4291, 2N4402, 2N4403, 2N5086, 2N5087, 2N5447.

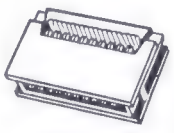
PN100.....T90001
PN200.....T90002

1-9	10+	100+
$0.20	$0.18	$0.15

SUPER BRIGHT LEDS

- RED.....Z10146
- GREEN.....Z10147
- YELLOW.....Z10148

1-9	10+
$1.00	$0.90



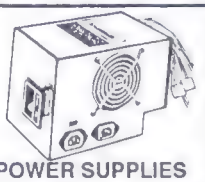
CARD EDGE CONNECTORS

.1" SPACING

	1-9	10+
P12060	10pin $3.95	$3.50
P12062	20pin $4.25	$3.75
P12064	26pin $4.50	$3.95
P12066	34pin $4.95	$3.95
P12068	40pin $5.95	$4.95
P12070	50pin $6.95	$5.95

DIODES - BUY IN BULK & SAVE!

Cat No.		10+	100+	1000+	10K
Z10135	IN4148	$0.05	$0.04	$0.03	$0.02
Z10105	IN4002	$0.06	$0.05	$0.04	$0.03
Z10107	IN4004	$0.08	$0.06	$0.05	$0.04
Z10110	IN4007	$0.10	$0.07	$0.06	$0.05
Z10115	IN5404	$0.18	$0.14	$0.13	$0.11
Z10119	IN5408	$0.20	$0.16	$0.15	$0.14



POWER SUPPLIES

XT P.S 150W.....$139.00
FULL TOWER
220W P.S.....$149.00
MINI TOWER
200W P.S.....$89.00
BABY AT
P.S 200W.....$89.00
SLIMLINE BABY AT
P.S. 200W.....$89.00

BREAD BOARDS

This inexpensive range of modular interlocking units enables a quick easy way of experimenting with new circiuts and ideas. There are two main units consisting of a terminal strip or distribution and a central plug in unit.

- 100 holes.

P11000.....$2.75

- 840 + 100 holes

P11007.....$14.95

- 1280 +100 holes
- P11010.....$26.95
- 2560 + 700 holes
- P11018.....$69.95

COMPUTER CABLES

- Six conductor shielded computer interface cable.

	1-9M	10M+	100M+
W12670 - CIC6 6 con.	$1.30M	$1.10M	$1.00M
W12672 - CIC9 9 con.	$1.60M	$1.50M	$1.20M
W12674 - CIC12 12 con.	$2.50M	$2.20M	$1.90M
W12676 - CIC16 16 con.	$3.50M	$3.20M	$2.50M
W12678 - CIC25 25 con.	$3.90M	$3.40M	$3.00M

NICADS

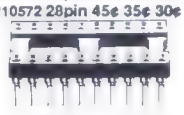
Save a fortune on expensive throw away batteries with these quality Nicads and Rechargers!

Size	1-9	10+	100+
AA 450mAH	$2.95	$2.75	$2.50
C 1.2 AH	$9.95	$9.50	$8.95
D 1.2 AH	$9.95	$9.50	$8.95

LOW PROFILE IC SOCKETS

Save a small fortune on these "Direct Import" low profile IC sockets! PCB mounting solder tail. All tin plated phosphor bronze or berryllium and dual wipe for reliability.

	1-9	10+	100+
P10550	8 pin	15¢	12¢	10¢
P10560	14pin	20¢	18¢	15¢
P10565	16pin	20¢	18¢	16¢
P10567	18pin	30¢	25¢	22¢
P10568	20pin	35¢	30¢	25¢
P10569	22pin	35¢	30¢	26¢
P10570	24pin	35¢	30¢	26¢
P10572	28pin	45¢	35¢	30¢



WIRE wRAP IC SOCKETS

These quality 3 level wire wrap sockets are tin plated phosphor bronze.

	1-9	10+
P10579	8pin	$1.50	$1.40
P10580	14pin	$1.85	$1.70
P10585	16pin	$1.95	$1.80
P10587	18pin	$1.95	$1.80
P10590	20pin	$2.95	$2.75
P10592	22pin	$2.95	$2.70
P10594	24pin	$3.95	$3.50
P10596	28pin	$3.95	$3.50
P10598	40pin	$4.95	$4.50

WOW! WHAT PRICES!

IDC PLUGS & SOCKETS WOW ! FROM $1.00

D TYPE IDC PLUGS

	1-9	10+	100+
- DE9P 9pin plug P12166	$1.50	$1.20	$1.00
- DA15P 15pin plug P12168	$1.50	$1.20	$1.00
- DB25P 25 pin plug P12170	$4.50	$3.95	$3.50

D TYPE IDC SOCKETS

	1-9	10+	100+
- DE9S 9 pin socket P12167	$1.50	$1.20	$1.00
- DA15S 15 pin socket P12169	$1.50	$1.20	$1.00
- DB25S 15 pin socket P12171	$4.50	$3.95	$3.50

IDC CENTRONICS 36 WAY PLUG & SOCKET

1-9	10+	100+
- Plug P12200 $3.95	$3.00	$2.95
- Socket P12201		

ECONOMY TRANSFORMERS

	1-9	10+
2155 240V 6-15V 1A M12155	$8.95	$7.95
2156 240V 6-15V A2 M12156	$13.95	$12.95
2851 240V 12-6V CT 250mA M12851	$4.95 ..	$4.50
6672 240V 15 30vc 1A tapped M16672	$12.95	$11.95

12V DC FANS

80 x 80 x 25.4mm
12V DC. 1.7 Watt 0.14 Amp
T12469.....$18.95
10+ fans, only $17.95

FANS

Quality fans for use in power amps, computer hotspot cooling etc. Anywhere you need plenty of air.

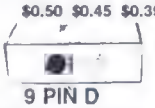
240V 4 5/8" T12461..$16.95
115V 4 5/8" T12463..$16.95
240V 3 1/2" T12465..$16.95
115V 3 1/2" T12467..$16.95

TOGGLE SWITCHES

	1-9	10+
S11010 S.P.D.T	$1.20	$1.10
S11020 D.P.D.T	$1.30	$1.20

ICB VOLTAGE REGULATORS BARGAINS

Description	1-9	10+	100+
7805UC	$0.50	$0.45	$0.40
7812UC	$0.50	$0.45	$0.40
7815UC	$0.50	$0.45	$0.40
7905UC	$0.60	$0.55	$0.50
7912UC	$0.60	$0.55	$0.50
7915UC	$0.60	$0.55	$0.50
78L05	$0.40	$0.30	$0.28
78L12	$0.40	$0.30	$0.28
LM324	$1.00	$0.90	$0.80
555	$0.40	$0.38	$0.33
741	$0.50	$0.45	$0.39



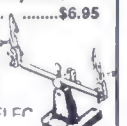
9 PIN D SWITCH BOXES

2 WAY.....$59.95
4 WAY.....$69.95
MONITOR & KEYBOARD SWITCH BOXES $69.50

MINIATURE HOBBY VICE

- Lever operated suction base grip for instant mounting & portability.
- Mounts on smooth non-porous surfaces
- Ideal for holding & other small objects .

T12458.....$6.95



PC BOARD HOLDER

Better than [illegible]

A must for all PCB work.

T12444.....$9.95

QUALITY 3mm LEDS

	1-9	10-99	100+	1K
1000+				
Z10140(R)	$0.15	$0.12	$0.10	$0.08
Z10141(G).	$0.20	$0.18	$0.15	$0.12
Z10143(Y)..	$0.20	$0.18	$0.15	$0.12
Z10145(O)..	$0.20	$0.18	$0.15	$0.12

QUALITY 5mm LEDS

Z10150(R).	$0.15	$0.12	$0.10	$0.08
Z10151(G).	$0.25	$0.20	$0.18	$0.12
Z10152(Y)..	$0.25	$0.20	$0.18	$0.12

FLASHING LEDS

	1-9	10+	100+
RED 5mm			
Z10159	$1.10	$1.00	$0.80

RECTANGULAR LEDS

	1-9	10+	100+	1K
RED	20¢	15¢	12¢	10¢
GREEN	20¢	15¢	12¢	10¢
YELLOW	20¢	15¢	12¢	10¢

DB25 CONNECTOR SPECIALS

	1-9	10+	100+
P10880 DE9P	$1.00	$0.80	$0.60
P10885 DE9S	$1.00	$0.70	$0.60
P10881 DA15S	$1.00	$0.70	$0.60
P10892 DA15C	$1.00	$0.90	$0.60
P10895 DA15S	$1.00	$0.80	$0.60
P10902 DB25C	$1.00	$0.80	$0.60
P10904 DB25P	$1.00	$0.80	$0.60
P10905 DB25S	$1.00	$0.80	$0.60

DO YOU NEED A UART SCOOP PURCHASE
16C450 (82450)
Features of a UART include programmable data format;parity,framing,and overrun error detection etc.

UNBELIEVABLE!!
U22185.....$9.95
SUPA HIGH SPEED UART

ELECTRET MIC INSERTS

With pins for easy board insertion. C10170

1-9	10-99	100+	1000+
$1.20	$1.00	$0.90	$0.70

TRANSISTORS BUY IN BULK & SAVE!

	1-9	10+	100+
BC 547	$0.15	$0.10	$0.07
BC 548	$0.15	$0.10	$0.07
BC 549	$0.15	$0.10	$0.07
BC 557	$0.15	$0.10	$0.07
BC 558	$0.15	$0.10	$0.07
BC 559	$0.15	$0.10	$0.07
BC 327	$0.20	$0.15	$0.12
BC 337	$0.20	$0.15	$0.12
BD 139	$0.75	$0.60	$0.50
BD 140	$0.75	$0.60	$0.50

PCB MOUNTING SCREW TERMINALS (INTERLOCKING ENDS)

These terminals feature interlocking ends to form any number of connections. Standard 5mm spacing pins.

P10520 2way

1-9	10_	100+
$0.75	$0.70	$0.60

P10521 3 way

1-9	10+	100+
$1.00	$0.90	$0.80

RITRON COMPUTER SYSTEMS
4 Years parts & Labour Warranty

RITRON EXECUTIVE 386SX-41

FREE! 18 MBYTES OF THE LATEST SHAREWARE SOFTWARE

NOW WITH 2 MEG OF RAM!

80386SX 33M CPU
2 MEG RAM EXP TO 8 MEG
41Mhz LANDMARK SPEED TEST
1.2M JAP F.D.D. 512K VGA CARD
40M HARD DISK DRIVE,
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & 200W POWER SUPPLY
SUPA VGA COLOUR MONITOR
1024 x 768 Res 0.28" D.P
SERIAL PARALLEL GAMES PORTS
4 YEAR PARTS & LABOUR
WARRANTY IBM* COMPATIBLE *18M OF SHAREWARE*
LATEST VGA GAMES
SPREAD SHEET, DATA BASE
WORDPROCESSOR,
*CASHBOOK SOFTWARE**
shareware Software.

$1,199 TAX INC.
$999 TAX EX

RITRON EXECUTIVE 386-65

NOW WITH 4 MEG OF RAM!

80386-40 CPU
128K CACHE ON BOARD
4 MEG RAM EXP TO 16 MEG
65 Mhz LANDMARK SPEED TEST
40 MEG HARD DISK 12ms ACCESS
TIME. 1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & 200W POWER SUPPLY
SERIAL, PARALLEL, GAMES PORTS
512K VGA CARD, SUPA VGA COLOUR MONITOR
(1024 x 768 Res) 0.28" 4 YEAR PARTS & LABOUR
WARRANTY SPEADSHEET, WORDPROCESSOR &
DATABASE SOFTWARE INCLUDED. *SHAREWARE SOFTWARE

$1,449 TAX INC.
$1,210 TAX EX.

WITH 200 MEG DRIVE
$1,649 TAX INC.
$1,399 TAX EX.

OPTIONAL EXTRAS
ON TOP OF BASE SYSTEM PRICE.

DR DOS 6.0 ADD.$40 MS DOS 5.0 ADD.$79
MS DOS 5.0 & WINDOW 3.1................$139.00
MS DOS 6.0 ADD $99
MS DOS 6.0 & WINDOWS 3.1..............$169.00
1M VGA CARD $75.00
386-40 UPGRADABLE MOTHERBOARD..$100.
LOCAL BUS VESA GRAPHIC CARD
TO SUIT ABOVE MOTHERBOARD.....$299.00
TO CHANGE A 40M HARD DRIVE TO A
85M HD add $80 131M HD add $110
105M HD..$90 200m HD add $200
170M HD..$180 345M HD add $500
425M HD add $690 512M HD add$1275

EXTRA RAM
1M add $69 2M add $138 4M add $276

SOUND CARDS
SOUND COMMANDER FX.........................$159
SOUNDBLASTER DELUXE With Speakers...$159
SOUNDBLASTER PRO...........................$279
FLOPTICAL DRIVE for 286 & 386 systems...$649
21 M/BYTE DISC TO SUIT......................$49
CD ROM SOUND BLASTER PACK..............$899
PARRADISE WINDOW ACCELERATOR.....$275
CASES MINI TOWER.$25 FULL TOWER.$175

RITRON EXECUTIVE 486-89

NOW WITH 4 MEG OF RAM!

80486SX-33 CPU 256K CACHE
4 MEG RAM EXP TO 32 MEG
75Mhz LANDMARK SPEED TEST
40 MEG HARD DISK
1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
MINI CASE & 200W POWER SUPPLY
4 YEAR PARTS & LABOUR WARRANTY
SERIAL, PARALLEL, GAMES PORTS, 512K VGA CARD
SUPA VGA COLOUR MONITOR (1024 x 768 Res) 0.28" DP
SPEADSHEET, WORDPROCESSOR & DATABASE
SOFTWARE INCLUDED. *SHAREWARE SOFTWARE
*ASSEMBLED & TESTED IN AUSTRALIA.**

$1,699 TAX INC.
$1,399 TAX EX.

WITH 200 MEG DRIVE
$1,899 TAX INC.
$1,599 TAX EX.

RITRON EXECUTIVE 486-157

NOW WITH 4 MEG OF RAM!

80486-33 CPU
256K ON BOARD CACHE. 4 MEG OF RAM
157Mhz LANDMARK SPEED TEST
40 MEG HARD DISK
1.2M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
512K VGA CARD. IBM* COMPATIBLE
SVGA COLOUR MONITOR (1024 x 768 Resolution) 0.28"DP
MINI CASE & 200W POWER SUPPLY
4 YEAR PARTS & LABOUR WARRANTY
SPREADSHEET, WORDPROCESSOR & DATABASE SOFTWARE.

$1,995 TAX INC.
$1,645 TAX EX.

WITH 200 MEG DRIVE
$2,195 TAX INC
$1,845 TAX EX

RITRON EXECUTIVE 486-157

NON-INTERLACED MONITOR

200M HARD DRIVE & TOWER

80486-33 CPU 256K ON BOARD CACHE. 4 MEG OF RAM
157Mhz LANDMARK SPEED TEST
200 MEG HARD DISK 5ms T.T ACCESS
TIME. 1.2M JAPANESE BRAND F.D.D
3.5" 1.44M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
1 MEG VGA CARD. IBM* COMPATIBLE
TOWER CASE & 220W POWER SUPPLY
NON-INTERLACED SUPA VGA COLOUR MONITOR
(1024 x 768 Res) 0.28" DP
4 YEAR PARTS & LABOUR WARRANTY
SPEADSHEET,
WORDPROCESSOR
& DATABASE SOFTWARE.
ASSEMBLED & TESTED
IN AUSTRALIA

$2,749 TAX INC.
$2,399 TAX INC.

RITRON EXECUTIVE 486-225+

NON-INTERLACED MONITOR

200M HARD DRIVE & TOWER CASE

80486DX-50 CPU 256K ON BOARD CACHE. 4 MEG RAM
200+Mhz LANDMARK SPEED TEST
200 MEG HARD DISK 5ms T.T ACCESS
TIME. 1.2M JAPANESE BRAND F.D.D
3.5" 1.44M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
1 MEG VGA CARD. IBM* COMPATIBLE
TOWER CASE & 220W POWER SUPPLY
NON-INTERLACED SUPA VGA COLOUR MONITOR
(1024 x 768 Res) 0.28" DP 4 YEAR PARTS & LABOUR
WARRANTY. SPEADSHEET, WORDPROCESSOR &
DATABASE SOFTWARE.
ASSEMBLED & TESTED
IN AUSTRALIA

$2995 TAX INC.

IDEAL CAD MACHINE! $2495 TAX EX.
Add $300 for DX66

RITRON EXECUTIVE 486-EISA

NON-INTERLACED MONITOR

200M HARD DRIVE & TOWER CASE

80486-33 EISA CPU 256K ON BOARD CACHE.
4 MEG OF RAM
167 Mhz LANDMARK SPEED TEST
200 MEG HARD DISK 5ms T.T ACCESS
TIME 1.2M JAPANESE BRAND F.D.D
3.5" 1.44M JAPANESE BRAND F.D.D
101 EXTENDED "CLICK" KEYBOARD
SERIAL, PARALLEL, GAMES PORTS
1 MEG VGA CARD. IBM* COMPATIBLE
TOWER CASE & 220W POWER SUPPLY
NON-INTERLACED SUPA VGA COLOUR MONITOR
(1024 x 768 Res) 0.28" DP
4 YEAR PARTS & LABOUR WARRANTY
SPEADSHEET,
WORDPROCESSOR &
DATABASE SOFTWARE.
80480-50 EISA extra $360

$3695 TAX INC.
$3100 TAX EX

RITRON 20" CAD/GRAPHIC WORKSTATION 486-250+

VERY VERY FAST

486-50 UPGRADABLE MOTHERBOARD WITH LOCAL BUS • MINI TOWER CASE & 200W P.S. • 8 MEG FAST PAGE MODE 60ns RAM VESA HIGH SPEED GRAPHICS CARD (LOCAL BUS) • 425M HARD DRIVE 5mS T.T ACCESS • 2 SERIAL PORTS & 1 PARALLEL PORT • 3.5" FLOPTICAL DRIVE • 1.2M BYTES FLOPPY DISK DRIVE • 101 HEAVY DUTY ERGONOMIC KEYBOARD • WINDOWS 3.1 & DOS 5.00 INSTALLED •20" SUPA VGA COLOUR MULTISYNC MONITOR • MICROSOFT COMPATIBLE JOYSTICK • 4 YEAR PARTS && LABOUR WARRANTY ONSITE (WITHIN 50KM OF OUR NUNAWADING (MELB) SERVICE CENTRE • FREE ONSITE DELIVERY
• ON LINE 9-5 TELEPHONE HELP LINE. SPECIALLY SELECTED COMPONENTS FOR MAXIMUM SPEED.

$6995 TAX INC. $5995 TAX EX.

ROD IRVING ELECTRONICS Est:1977

MAIL ORDER HOTLINE: 008 33 57 57. ORDER FAX LINE: (03) 543 4871 ENQUIRES (03) 543 7877
HEAD OFFICE: 56 RENVER RD, CLAYTON. PH: (03) 543 2166. FAX (03) 543 2648
MELBOURNE: 48 A'BECKETT ST. MELBOURNE. PH. (03) 639 1640. FAX: 639 1641.
OAKLEIGH: 240C HUNTINGDALE RD, OAKLEIGH. PH: (03) 562 8939 FAX: (03) 562 8940
NORTHCOTE 425 HIGH ST. NORTHCOTE, PH. 489 8866. FAX: 489 8131.
NEW STORE: BOX HILL 1031 MAROONDAH HWY, BOX HILL. PH:(03) 899 6033 FAX:(03) 899 0156
SYDNEY:74 PARRAMATTA RD, STANMORE. PH: (02) 519 3134. FAX: (02) 516 5024.
ADELAIDE: 241-243 WRIGHT ST, ADELAIDE. PH:(08) 211 7200 FAX: (08) 211 7273
BLUESTAR COMPUTERS:
MELBOURNE: 271 MAROONDAH HWY, RINGWOOD, PHONE: (03) 870 1800 FAX: (03) 879 3027
SYDNEY: 115 - 117 PARRAMATTA RD CONCORD. PH: (02) 744 5526 FAX: (02) 744 5405.

FREIGHT CHARGE BASED ON 35KG COMPUTER SYSTEM

Melb-Metro.$12.00	Vic country....$19.00
Sydney.......$17.00	NSW country.$39.00
Adelaide.....$17.00	S.A country...$39.00
Bribane.......$24.00	QLD country.$55.00
Canberra....$18.00	W.A country..$74.00
Darwin.......$40.00	Insurance:-
Perth..........$31.00	$1 / $100 Value.
Tasmania....$53.00	

OUR POLICY.
Come to us with a written quote on a computer system and we will beat that price. WE WON'T BE UNDERSOLD!*
*Conditions Apply.
Tax ex. Orders: Ritronics Wholesale: Ph:(03) 543 2166. Fax: (03) 562 7734

RIE BULLETIN BOARD: (03) 562 7903
For Specials, Service & Information.

Circuit & Design Ideas

Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Pulser probe

This circuit will generate either a single pulse or a stream of pulses, depending on the length of time switch SW1 remains pressed.

The circuit will power up with the probe output sitting in a high impedance state. The outputs of IC1a, IC1c and IC1d are high, while that of IC1b is low. Capacitor C2 will charge up via resistor R2.

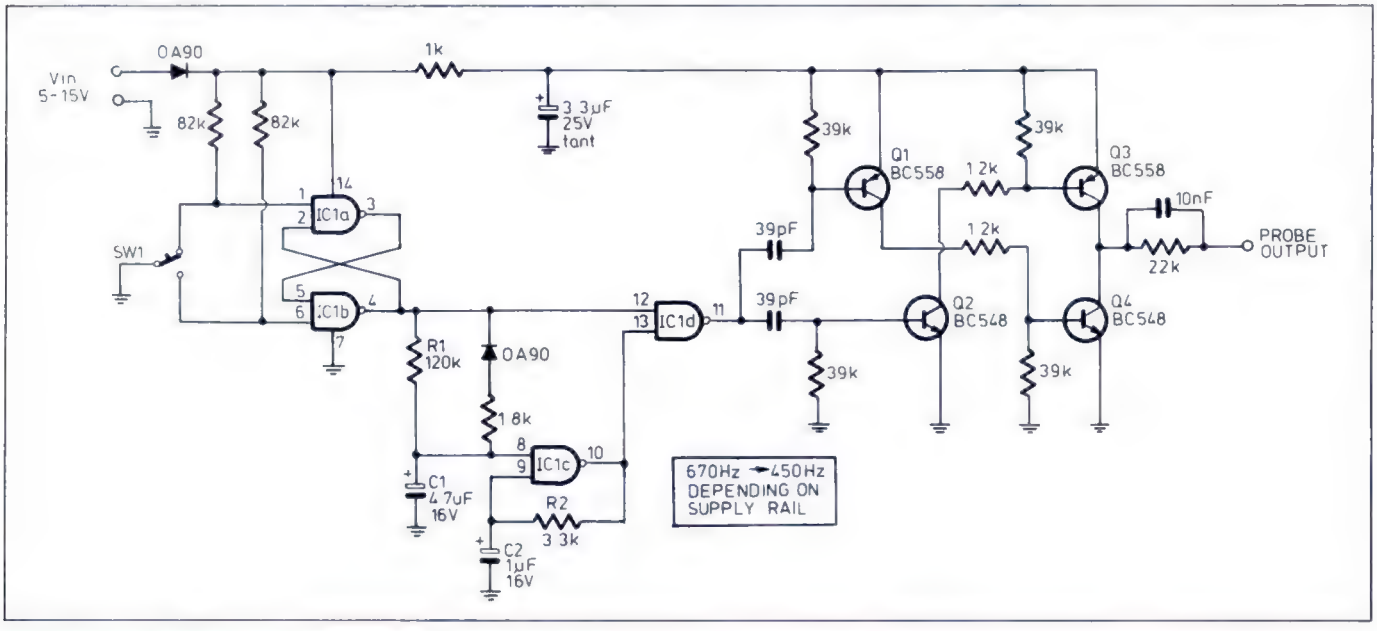
SW1 is a momentary break-and-make switch. When it is pressed, this flips the output of IC1b, which in turn generates a high-to-low transition at pin 11 of gate 1d. This high switches on transistors Q1 and Q4, thus pulling the probe output low. Releasing SW1 causes pin 11 of IC1d to go from low back to high, which switches on transistors Q2 and Q3, pulling the probe output high.

If the probe is touching an undefined voltage level, that point will initially be pulled low and then taken high by the quick operation of SW1.

If SW1 is held down for about one second, capacitor C1 will charge up via resistor R1 from pin 4. This will eventually pull pin 8 of gate 1c high, enabling the oscillator built around that gate. Its frequency will be around 450 to 670Hz, depending on the supply rail.

Transistors Q3 and Q4 will be driven alternately, pulling the probe output high and low. The circuit generates a 0.5us pulse, when over-riding a 74HC type gate output. The pulser probe was built on a small piece of matrix board, with point-to-point wiring techiques employed where necessary.

Gregory Freeman,
Nairne, SA. **$40**

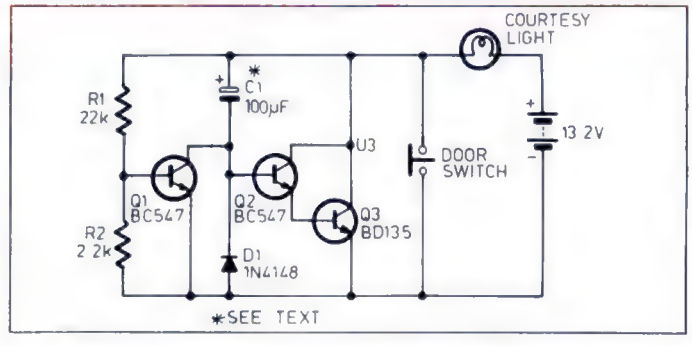


Courtesy light delay

Have you ever wished that the courtesy light in your car would stay on for a while after you have closed the door, so that you can put the key in the ignition, etc? This circuit grants your wish.

The circuit is wired in parallel with the door switch. When the car door is closed (and the switch is opened), capacitor C1 charges through the Darlington pair Q2 and Q3, keeping the lamp on. U3, the collector voltage of Q3 slowly rises and the lamp dims. When U3 reaches about 5V, transistor Q1 turns well on, which causes Q2 and Q3 to turn off. The more they turn off, the more Q1 turns on. U3 rises rapidly due to this positive feedback, and the lamp goes out. The only current drawn in this state is through resistor R1.

The rate of dimming depends on the current drawn by the lamp, the gains of Q2 and Q3, and the value of C1. Some experimentation with C1 may be required to establish the right value. Diode D1 provides a path for the rapid discharge of C1 when the door switch is closed.



Any medium gain small signal transistors are suitable for Q1 and Q2, while Q3 should be a medium power type capable of switching 1A. No heatsink is required. A search through the junk box should uncover some suitable specimens for recycling.

Ken Yap,
Lane Cove, NSW **$40**

Cat detractor

Ever had your nylon screen door mesh repeatedly ripped by good old puss trying to get in? Well I have. Changing to metal mesh saved the door, but not the noise.

Here is a circuit to teach puss that touching that door may not be a good idea. It is a safe HV pulse generator that connects between the mesh and a 'groundmat' made with conductive material such as damp carpet or conductive plastic matting.

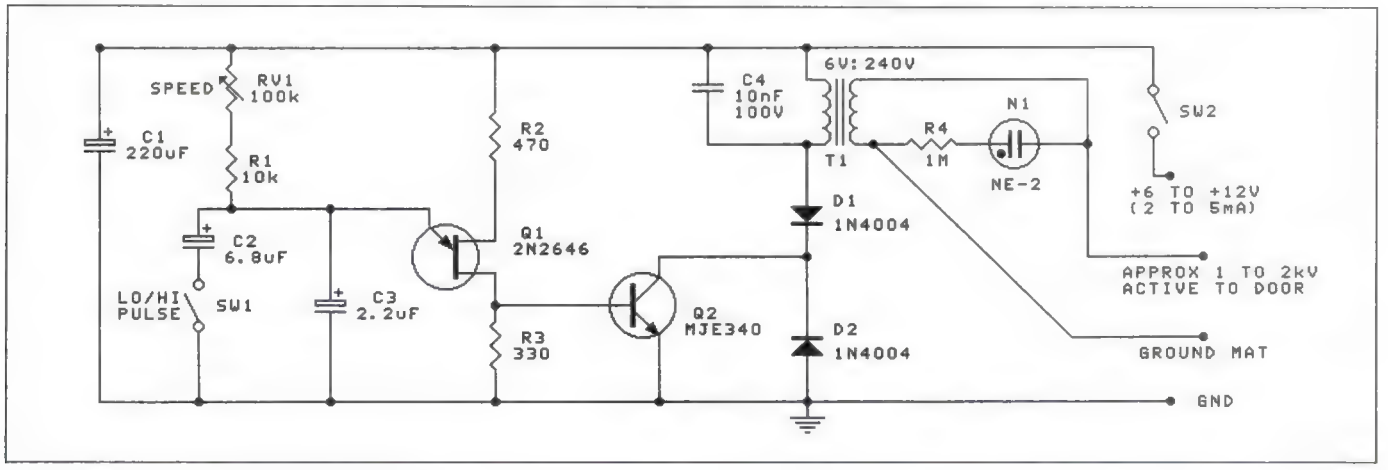
Battery life is maximised by drain of a few milliamps only, yet the circuit produces an output over 1kV, which is sufficient to cause a response without pain. Relaxation oscillator UJT Q1 (2N2646) provides positive pulses into transistor Q2 (MJE340), which in turn drives a small mains transfer T1, via its 6.3V winding. Insulation breakdown doesn't appear to be a problem, even with miniature transformer types.

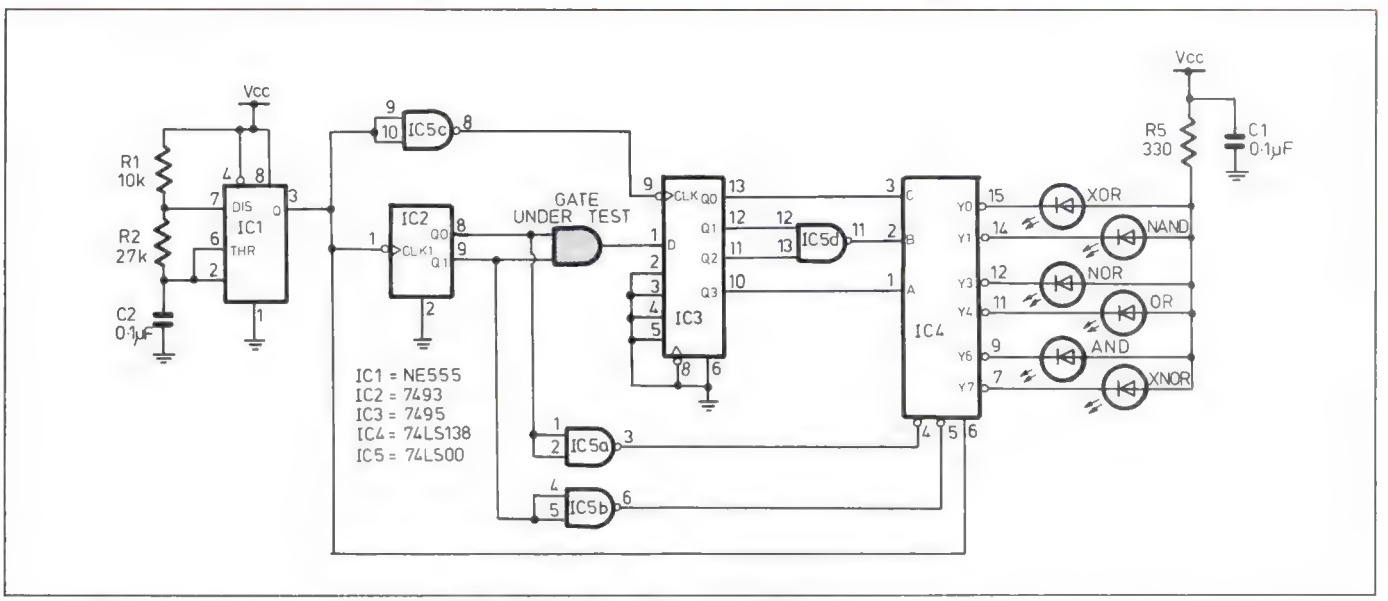
Output pulse shaping is by the two diodes D1 and D2 (which are not present for protection, as the MJE can cope) and capacitor C4 across the low voltage winding. The LO/HI switch SW1 selects fast pulses with 'bite', or even slower pulses with more bite. The speed control RV1 alters the pulse rate to ensure that the beastie is not too quick for a reprimand. Without O/P leakage paths, the neon N1 should flash repeatedly, indicating the presence of the pulses.

PS. No, I am not a cat hater!

Warwick Talbot,
Toowoomba, Qld. **$45**

(Editors Note: This project may not be suitable for households with young children. It should also be pointed out that anyone touching the door will receive the same reprimand.)





Logic gate identifier

This simple circuit can be used to quickly and easily identify TTL and CMOS 2-input gates. It uses LEDs to indicate the type of gate under test, e.g., AND, NAND, OR, NOR, XOR and XNOR.

The circuit works as follows: the 555 timer (IC1) is used in an astable mode to produce the required clock for the system. The four bit 74LS93 counter (IC2) cycles through all the possible input combinations for the two input gate, 00, 01, 10 and 11.

The output of the gate under test is then fed to a shift register 74LS95 (IC3). After the entire input sequence has been applied, IC3 contains the signature for that particulate gate.

The two NAND gates (IC5) activate the decoder chip, 74LS138 (IC4), as soon as the whole truth table has been entered into the shift register. Proper operation of this register is assured by inverting the clock signal using IC5c.

To use the identifier, simply connect the inputs of the unknown gate to pins 8 and 9 of the counter (IC2), with its output to pin 1 of the shift register (IC). The appropriate LED will light up to show you what type of gate it is.

D. Klimovski and A. Cricenti,
East Coburg, Vic. **$45**

Construction project:

Low cost noise and distortion meter - 2

As promised last month, here are the construction details for our new noise and distortion meter project. Also included are the calibration particulars, a guide to its operation, and hints on how best to interpret the results. Once it's up and running, you should find it to be a very handy instrument indeed...

by ROB EVANS

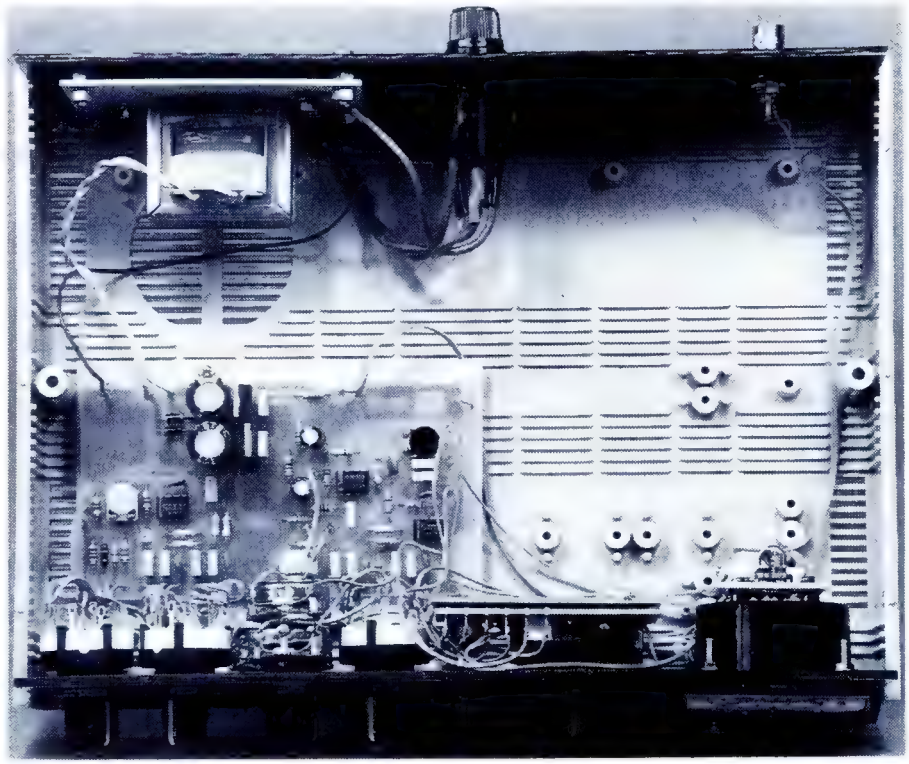
With the noise and distortion meter's circuit description and parts considerations covered in our last instalment, you can now begin the construction process in earnest. Fortunately, this is a reasonably straightforward task, with the only fiddly jobs being completing the wiring between the front panel controls (pots and switches) and the PCBs.

The first step is to fit all of the components onto the PCBs as shown in the component overlay diagram. As usual, start with the smaller parts and work your way through to the larger items, while paying particular attention to the orientation of any polarised components such as the semiconductors and electrolytic capacitors.

Note that there are a number of PCB pins used in all three boards, which should be fitted before any of the larger components are installed. These are used for making many of the off-board connections, and in the case of the larger main board, are also used to locate the assembly on its section of blank shielding PCB — each of the three mounting points is indicated by an 'X' on the component overlay. Specifically, the main board has 15 pins while the millivoltmeter's amplifier and meter drive boards have six and five pins respectively.

Once the circuit board assemblies are complete, you will need to make the shielding boards for the main PCB and the millivoltmeter amp PCB, which are simply cut from a section of blank single-sided board.

As you can see from the shots of the prototype, the shield for the main PCB has been made slightly larger than its host board to allow room for its mounting screws — which, needless to say, must line up with a couple of the case's moulded mounting pillars. In turn, the main board assembly is mounted to the shield board via three short lengths of solid wire (or component leg offcuts), which are mounted into holes in the shield board then soldered to the matching PCB pins in the main board, as mentioned above.



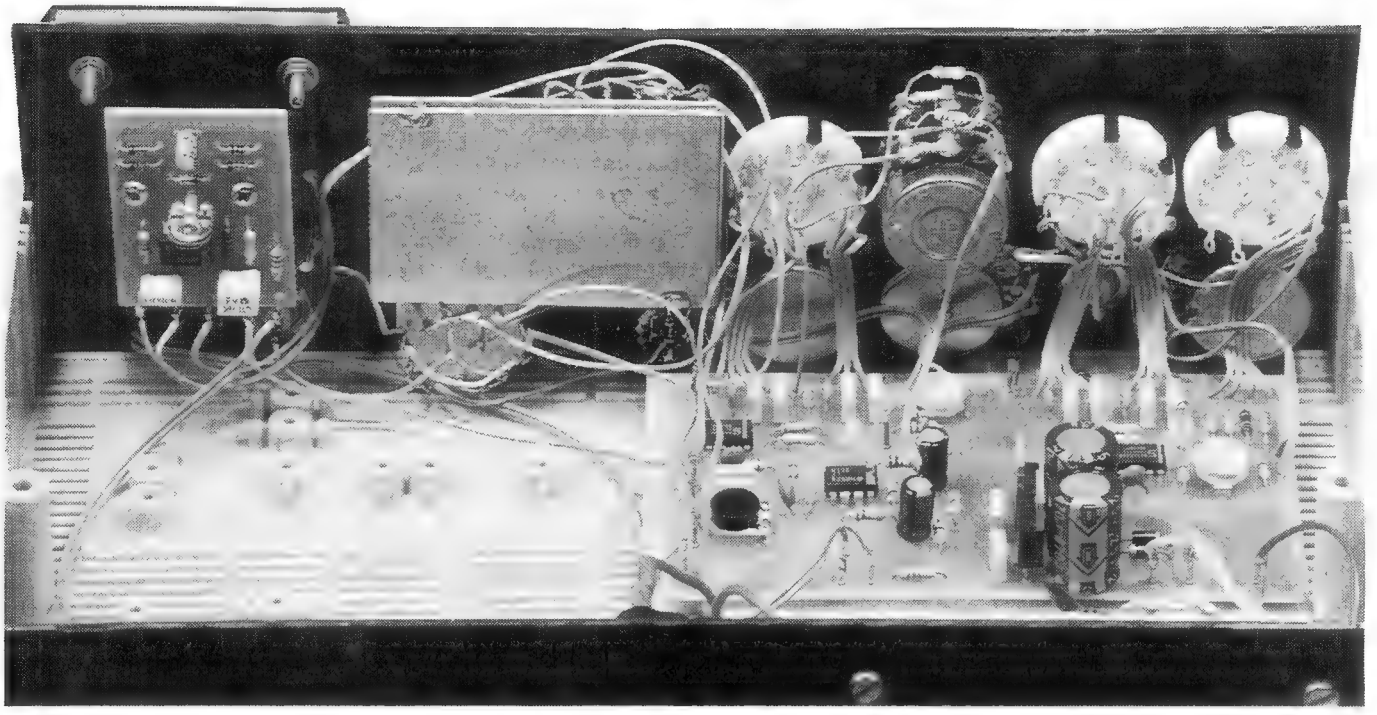
A total of three PCBs are used in the unit. The main board mounts into the bottom of the case, while the meter amplifier and meter drive boards mount onto the back of the front panel components.

While this mounting method may seem a little crude to some, we found that in practice it locates the main board quite securely, and is the simplest way to hold the two boards together while still allowing for easy access when performing repairs or modifications.

The shield for the meter amplifier on the other hand, is cut to the same size as its host board, and is attached via two short lengths of solid wire between the copper side of both boards.

To mount this shield, first solder the pieces of wire (again, component leg offcuts if you prefer) to the two points on the copper side of the meter amp PCB which are marked with a small 'x' on the overlay diagram (there's one near the end of IC3).

Then lay the shield board against the meter amp board with its copper side facing out, fold the free end of the wires around the edges of the shield board, and solder the ends in place.

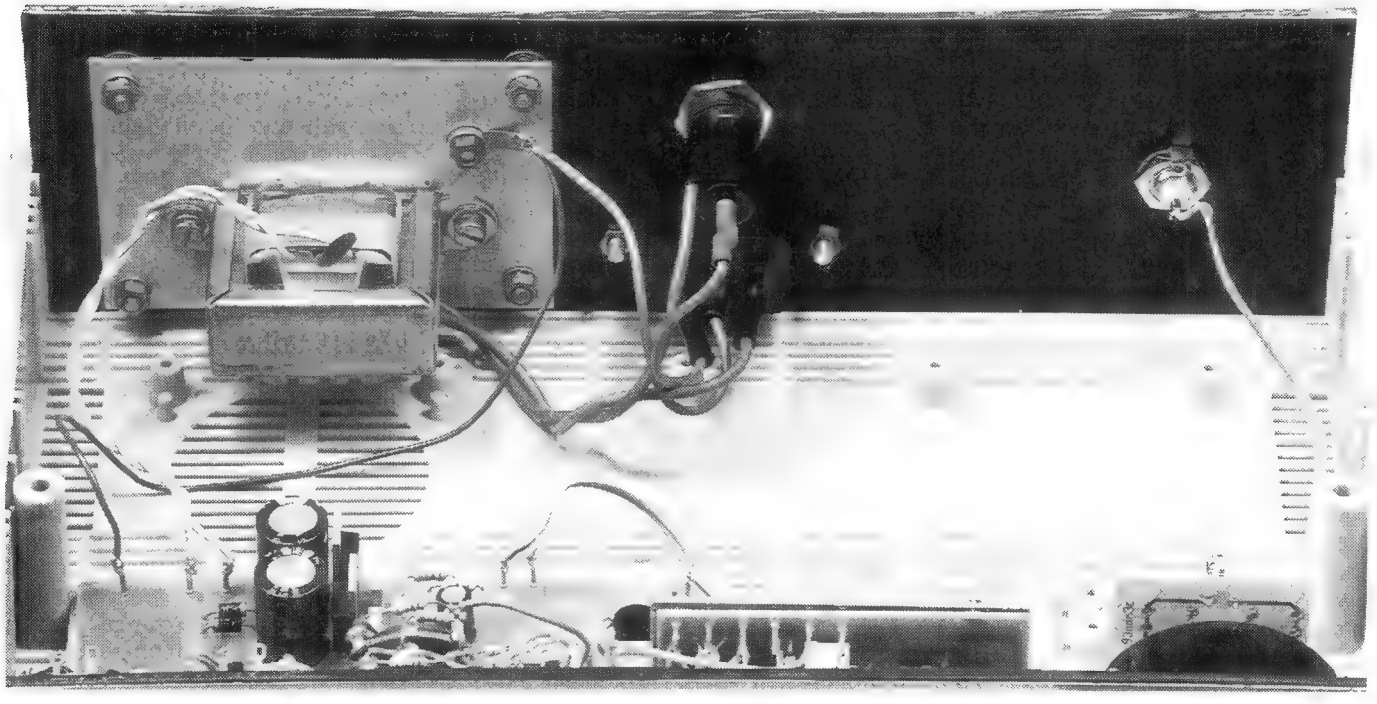


Both the main PCB and the meter amplifier PCB are fitted with additional sections of blank board, to provide shielding for the sensitive areas.

Before mounting the circuit board assemblies into their final positions or installing the front panel controls, you will need to complete most of the wiring between the two. Note that this task is much easier at this stage, since you have unobstructed access to the pot and switch connections when they are free of the front panel. Note that this is also the best time to install the resistors which mount onto the pot lugs (R7, R8, R11, R12, and R15).

The neatest way to form the wiring between the main board and the various controls is to use moderate lengths of ribbon cable ('rainbow' wire, or similar), which have been separated into the appropriate number of conductors for each wiring job. Taking the oscillator's Range control (SW6) for example, you will need to run a group of *four* conductors from the main board, and use just single wires for the connections to the output socket and the wiper of the RV8 (Level) — as shown in the component overlay diagram.

Once this is complete, you can mount the controls, sockets and the meter into the front panel, and fit the circuit boards in place. As mentioned above and shown in the shots of the prototype, the meter



Take particular care with the mains wiring. The transformer should be mounted on an aluminium plate, and sleeving fitted to the fuse and IEC plug terminals.

drive PCB is fitted to the back of the meter itself, and you don't need to actually 'mount' the meter amplifier board, as it's supported by SW4. After that, the remaining wiring between the boards (and controls) can be completed as shown in the overlay diagram.

At some point of course, you will also need to fit all of the mains hardware and wiring to the unit's rear panel. Here, both the transformer and the main earthing lug are bolted to a section of aluminium plate using nuts, screws, flat washers and locking (star) washers, then the whole assembly is bolted to the rear panel alongside the IEC mains plug and the fuseholder, as shown by the inside shots of the prototype.

Next, carefully complete the mains wiring, while insulating any exposed joints using heatshrink tubing or mains-rated sleeving material as you go. Fit a mains-rated length of earth wire (green or green/yellow striped insulation) between the IEC plug's 'E' terminal and the solder lug on the transformer plate, then solder the transformer primary's blue wire to the pin marked 'N' on the IEC plug.

After that, connect the transformer's brown primary wire to the lug on the body of the fuseholder (the one nearest the panel), and run a short length of red mains-rated wire from the remaining fuseholder terminal (the 'tip') to the lug marked 'A' on the IEC plug. Then for your own safety, double check that the connections are correct and all exposed mains connections have been well covered.

Finally, wire the transformer's secondary wires to the appropriate PCB pins on the main circuit board, and complete any remaining connections as per the component overlay diagram. Note that while we have included an earth wire from the main PCB to the earthing lug on the transformer plate, this may compromise the performance of the instrument when measuring very low levels of distortion...

Earthing

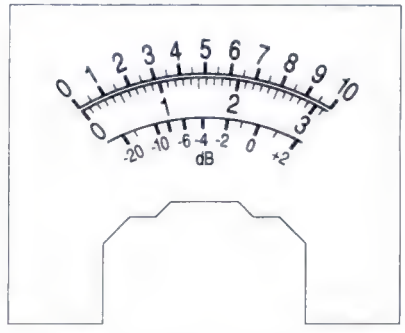
The problem with just about any mains-powered test instrument which has a high input sensitivity is the interaction between its own internal earth connection (the 'mains' earth) and that of the device under test — assuming that it is also earthed to the mains. In short, we're really talking about the hoary old problem of earth loops.

In the case of the noise and distortion meter, your best bet is to simply see how it performs in its standard form, in your testing environment. Then if you're sure that mains hum is being introduced by the multiple earth paths, try temporarily disconnecting the abovementioned earth wire (say at the main PCB), and see if the situation improves.

Note also that if you have an oscilloscope connected to the unit, this will *also* provide a path to the mains earth — try disconnecting the wire attached to the grounding lug on the CRO output BNC socket to check the oscilloscope's effect.

Other than that, you should also consider the grounding arrangement within the instrument itself. While we've added R49 to isolate the ground path of the oscillator and power supply from that of the distortion meter circuitry, this will only be the case if the input and output BNC sockets are also isolated at the front panel.

Therefore, if you intend to use an aluminium dress plate (such as Dynamark) as in our prototype, you will need to insulate the input BNC socket from the front panel — its aluminium surface is conductive, of course.



Here's the full sized artwork for the meter face.

We used a small section of blank PCB for this job, however just about any insulating material will do. It's also important to note that the Dynamark panel provides an earthing path for the bodies of the unit's four pots, which should be connected to ground by other means if you are using just the plastic front panel.

Testing & adjustment

Once you've finalised the unit's construction, apply power and check that the power LED illuminates, indicating that the positive supply rail is present. Then check that the power supply rails are at the correct +/-12V levels, and the regulator ICs are running at a relatively low temperature — at the most, they should feel warm to the touch.

If all is well, adjust the oscillator's output controls for a maximum level at 100Hz and monitor its output with either an oscilloscope, or a multimeter set to its AC volts range. Note that since RV7 has not been adjusted at this point, don't be surprised to find that the oscillator is generating square waves, or no output at all — in this case, simply adjust RV7 until a sine wave is present.

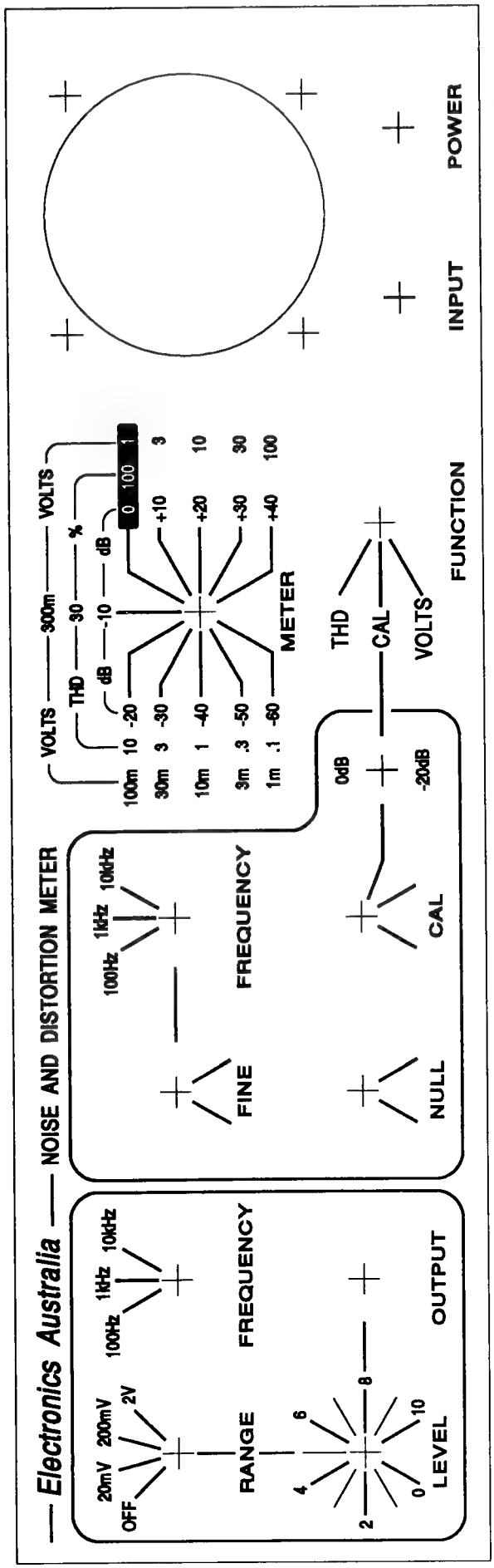
On the other hand, you might find that there is no activity at the oscillator's output socket regardless of RV7's setting. In this situation, you will probably find that a waveform is present at the oscillator's 'raw' output (say at R23), and you may have inadvertently reversed the connections at the output controls (SW5 or SW6) — bear this potential error in mind when checking the instrument's other switches.

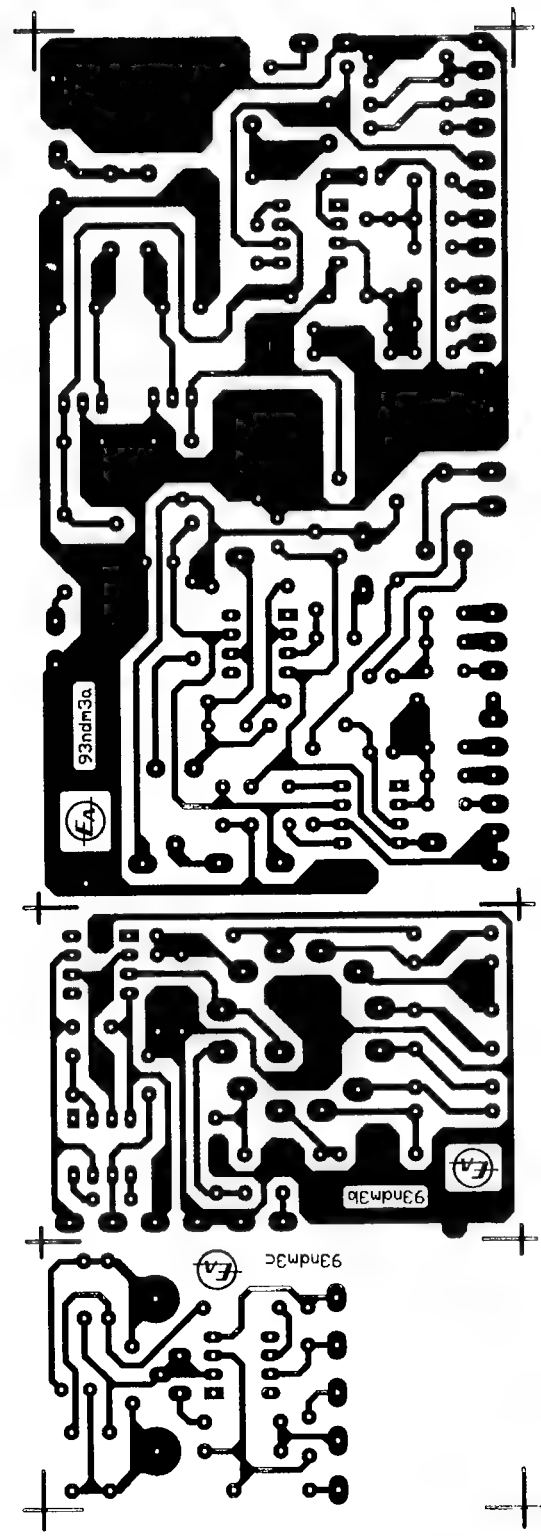
The oscillator's output can now be accurately adjusted, and then used as a reference to set up the rest of the instrument. For most constructors' needs, the AC range of a standard digital multimeter (DMM) will have sufficient accuracy for this job, provided that you are reading a relatively large, low-frequency signal — that is, the oscillator's full 2V level while on the 100Hz range. After double checking that the oscillator's controls are indeed set to its maximum output level, adjust RV7 for an output reading of exactly 2V RMS.

Next, set the unit's function switch to the voltmeter position (VOLTS), adjust the meter attenuator control to the 3V (+10dB) range, and link the oscillator output socket to the main input socket with a suitable cable. Then adjust trimpot RV6 on the meter drive board so that the instrument's meter is reading 2 volts. At this point, you may like to check the reading is consistent when the oscillator is switched to its 1kHz and 10kHz positions.

With the oscillator back on the 100Hz setting, now turn the function switch to 'THD', the notch filter's frequency control (SW3) to 1kHz or 10kHz, and the attenuator switch (SW2) to the reference position (100%). Next, adjust the Cal control (RV1) for a full-scale meter reading (10), then switch the function switch to 'CAL' and adjust trimpot RV3 for the same reading (10). This procedure adjusts the signal loss through the CAL circuit to match that of the THD circuit (the notch filter).

Finally, you'll need to adjust RV4 so that the Null control operates over the correct range. Here, turn the function switch back to THD, the filter's frequency to 100Hz (the same as the oscillator), the Null control to its *mid-position*, and adjust the Fine control for a minimum reading. Then adjust RV4 for a further dip in the reading, indicating that the Null control is now at about the right setting — note that this trimpot (RV4) is effectively a 'null-coarse' control.





Shown at the left is the full sized artwork for the front panel for those that wish to make their own. At right is the actual sized PCB artwork , for etching your own boards.

Noise & Distortion meter - 2

You will then need to run through the above procedure with both the oscillator and notch filter in their 1kHz and 10kHz positions, since the Null control will have a different setting for each test frequency. By noting these three positions, you should be able to adjust RV4 so that they are spread over the normal range of the Null control, and the filter can be successfully 'nulled' for all test tones.

If this cannot be done, you will need to take another look at the component values in the filter's Wien bridge, as outlined above. On the other hand, you can simply increase the range of the Null control by raising the value of its shunt resistor, R15.

In this case however, you will find that the control becomes extremely sensitive when you are dealing with low distortion levels, and may prove to be quite impractical for setting the filter's null balance.

Once you are happy with the operation of the Null control, your instrument is now calibrated and ready to go.

Operation

As you may have gathered from the circuit description, the noise and distortion meter's operation is pretty straightforward, despite the large number of front panel controls.

To measure the incoming signal level, simply connect the source to the unit's input socket and select VOLTS on the function switch. Then as with any other analog voltmeter, adjust the meter attenuator switch (SW4) until the pointer is reading in the upper two thirds of the scale, and note the result.

To measure distortion, you'll need to connect the input of the device under test (DUT) to the oscillator's output, and connect the output of the DUT to the meter's input socket. And by the way, if the DUT is an audio amplifier, its output would normally be connected to a suitable dummy load as well.

Once you have set the oscillator's Level and Range controls to a suitable signal level for the DUT, turn the meter sensitivity control to the reference mark at 100% (1V, 0dB), select CAL on the main function switch, and adjust the attenuator switch (SW2) and Cal control (RV1) carefully for a full-scale meter reading (10) — this corresponds to a distortion level of 100%.

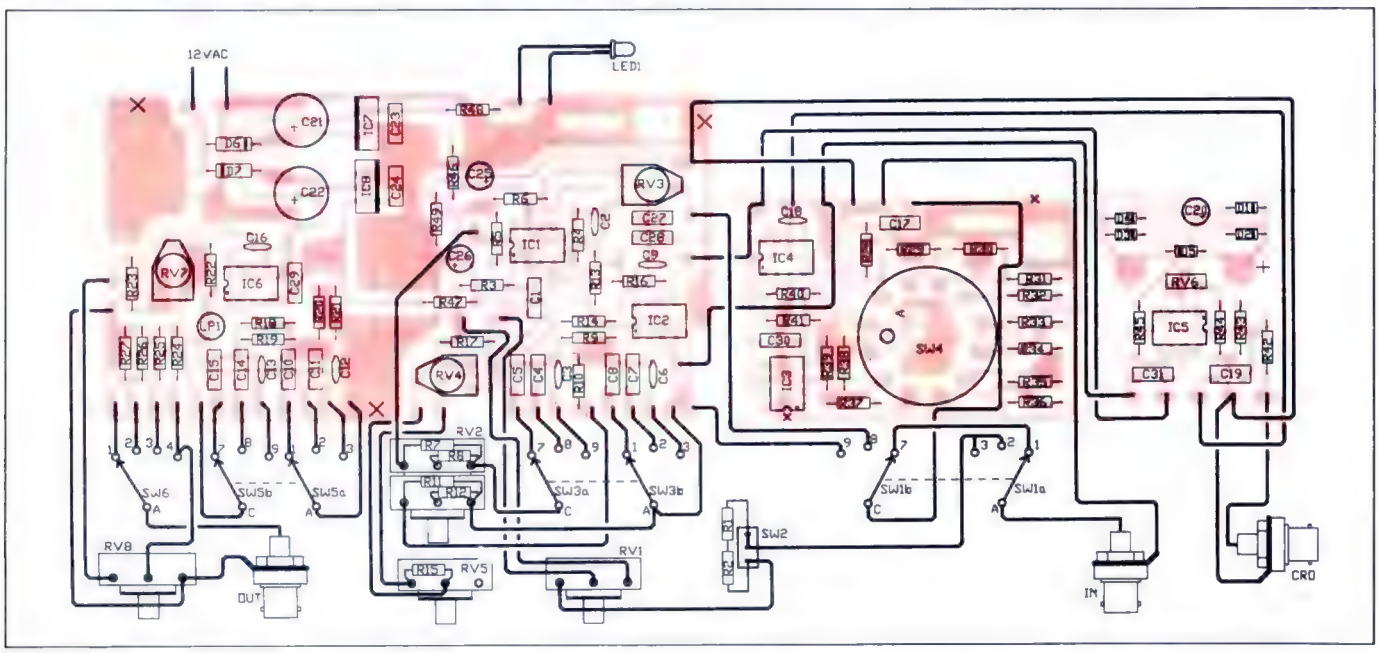
Then switch the notch filter's Frequency control to match that of the oscillator frequency (say 1kHz), turn the function switch to THD, and adjust both the Null and Fine controls for a minimum meter reading. Now move the Meter switch to the next most sensitive position (30%) and readjust the Null and Fine controls for the lowest reading.

Continue this process of tuning, then selecting a more sensitive scale, until you've arrived at the lowest possible reading. You can then read the distortion of the DUT directly from the meter scale. This will be on either the 0-to-10 or 0-to-3 scale, depending upon the position of the meter attenuator control, which moves in alternate multiples of 10 and 3 (10dB steps) At this point it's important to remember that the reading corresponds to the distortion *plus noise* of the DUT, since the filter has only removed the test tone's fundamental frequency, and all other artifacts remain. If the DUT is a power amplifier for example, the noise component will probably be much smaller than the distortion by-products, whereas a high-gain preamp may well exhibit the opposite conditions. In any case, you can judge the nature of the signals being measured by connecting an oscilloscope to the instrument's CRO output — more of this later.

To measure just the relative *noise* of the DUT, first complete the calibration process as outlined above (function switch to CAL, meter switch in the reference position), except in this case, adjust the pointer to read 0dB rather than full-scale. Then remove the drive signal to the DUT by switching the oscillator to its OFF position (SW6) — or better still, disconnecting the DUT's input and substituting a shielded terminating resistor (say 600 ohms).

Leaving the function switch in the CAL position, now progressively select more sensitive ranges on the meter attenuator switch until you have a reasonable degree of pointer deflection. Since you started at 0dB (the reference), you can now read the relative level of the noise in decibels from the scale and the attenuator switch.

Besides its basic operation, there are a few additional aspects to consider when it comes to using the noise and distortion meter in earnest. The first thing that you'll probably notice is that the lower the distortion levels you are reading, the more sensitive the notch tuning controls seem to become. In practice, this means that when you're



The component overlay diagram. Follow this at all times during the construction of the noise and distortion meter.

PARTS LIST

Resistors

(All 0.25W 5%): 1 x 2.2M, 1 x 680k, 1 x 220k, 1 x 150k, 2 x 120k, 1 x100k, 2 x 68k, 3 x 47k, 1 x 33k, 2 x 27k, 2 x 22k, 1 x 15k, 4 x 10k, 3 x 4.7k, 1 x 3.3k, 1 x 1.5k, 2 x 1k, 2 x 680 ohms, 3 x 470 ohms, 2 x 390 ohms, 1 x 220 ohms, 1 x 180 ohms, 1 x 150 ohms, 1 x 68 ohms, 5 x 47 ohms, 1 x 15 ohms, 1 x 10 ohms, 1 x 4.7 ohms, 1 x 2.2 ohms

Variable resistors

1 100k single-gang linear pot
1 10k dual-gang linear pot
1 1k single-gang linear pot
1 500 ohms single-gang linear pot
1 5k horizontal-mounting trimpot
1 2k horizontal-mounting trimpot
1 500 ohm horizontal-mounting trimpot
1 100 ohm vertical-mounting trimpot

Capacitors

2 470uF 16VW PC-mount electrolytics
2 100uF 16VW PC-mount electrolytics
1 4.7uF 16VW PC-mount electrolytic
1 0.18uF MKT polyester
7 0.1uF MKT polyester
5 47nF MKT polyester
1 10nF MKT polyester
4 4.7nF MKT polyester
4 470pF ceramic
1 150pF ceramic
3 33pF ceramic

Semiconductors

3 NE5534 opamps
3 TL071 or LF351 opamps
1 7812 +12V regulator
1 7912 -12V regulator
2 1N4002 power diodes
5 1N914 or 1N4148 signal diodes
1 5mm red LED, plus mounting flange

Miscellaneous

3 PC boards, coded 93ndm3a, 93ndm3b and 93ndm3c
1 Plastic instrument case, 260 x 190 x 80mm
1 12.6V/150mA 2851-type mains transformer
1 Miniature incandescent lamp, 12V/50mA or similar
1 MU-45 type meter, 58 x 52mm, 1mA FSD
3 2-pole 6-position 'programmable' rotary switches
2 1-pole 12-position 'programmable' rotary switches
1 SPDT miniature toggle switch
9 Plastic knobs, two large and seven small
3 Panel mounting BNC sockets
1 Panel mounting IEC-type mains plug
1 3AG panel mounting fuse holder, with 500mA fuse

Solder lug, hookup wire, PCB pins, blank PCB, aluminium plate, heatshrink tubing, nuts, bolts, lockwashers, etc.

reading distortion figures below 0.1%, the filter's Fine and Null controls need to be very carefully adjusted to achieve a meaningful result.

This effect is not really that surprising when you consider the way in which the circuit works; since under these conditions the meter is operating at its full sensitivity, and is effectively 'looking' at the *narrowest* (that is, deepest) part of the notch — a small shift in the notch tuning, and it's no longer fully rejecting the fundamental.

However, it's in this situation where the unit's CRO output is of considerable advantage, since the oscilloscope can act as a very effective 'tuning aid' for the notch filter, by displaying the wave shape of the distorted output. Just how you judge the tuning from this waveform is rather difficult to describe in words, but rest assured, you develop a 'feel' for this tuning method in short order. After a little practice, we were able to reliably read distortion levels of less than 0.01%.

The other benefit of the CRO output is that the oscilloscope can provide valuable information regarding the harmonic (or otherwise) nature of the distortion artifacts. Because you know the frequency of the reference signal source, you can easily calculate whether the by-products are odd- or even-harmonics of the fundamental, injected from some other source (mains hum, RF interference), or spurious signals as the result of a circuit's instability.

So as well as having the ability to *measure* a device's distortion, you can also make quite accurate judgements regarding the *type* of any distortion by-products. In short, connecting an oscilloscope to the noise and distortion meter makes it an even more useful instrument.

Another aspect that you should be aware of when making distortion measurements is how the meter responds to different types of waveforms. As the meter is *not* a true RMS-reading voltmeter, it is only truly accurate for sine wave signals — but unfortunately, distortion by-products can take on a variety of wave shapes.

If we are measuring the distortion of a device which is being driven into clipping for example, the waveform of the by-products would be a series of positive and negative spikes, with each one corresponding to the peaks of the original waveform; this type of distortion would read a little low on our metering circuit. On the other hand, common *harmonic* distortion will effectively have a number of sine waves (at frequencies related to the fundamental) as by-products, and will read quite accurately.

When it comes to reading very low levels of noise or distortion, you should also be aware of the instrument's own internal contribution to the reading, since it too will have small amount of residual noise and distortion — the unit's measurement 'floor', if you like. In real terms, the prototype exhibited a floor of around 0.003% THD, or about 90dB below the reference level.

All in all though, you should really regard any very low level readings as relative rather than absolute measurements, since a number of errors start to creep in under these conditions. Besides the unit's own contribution as mentioned above, the meter movement itself will become somewhat non-linear at the bottom of the scale.

So that's about it for driving the noise and distortion meter. You should find its operation quite straightforward, and the performance to be more than adequate for all but the most demanding of audio measuring jobs. Its biggest value probably lies in acting as a development tool for your own circuits and designs, and as a general audio signal generator and measuring instrument around the workshop.❖

Another use for the NDM: measuring SINAD

A widely accepted standard for measuring a radio receiver's usable sensitivity is by the 'Signal Including Noise and Distortion' (SINAD) technique. And as it happens, all that you really need to make these measurements is a standard RF signal generator, plus a high-rejection 1kHz notch filter and an AC voltmeter — such as those contained in our new Noise and Distortion Meter (NDM).

To perform this test on a FM receiver for example, first connect the generator's output to the set's antenna input and monitor the receiver's audio output with the Noise and Distortion meter. Then set the output of the generator for a reasonable level of deviation (say 60%) at a modulation frequency of 1kHz, and adjust the receiver to deliver a substantial audio output level (say at least 50% of its rated power).

Next, calibrate the NDM to this level (with the controls set to CAL), switch in the notch filter (the THD position) and tune this to minimise the 1kHz tone reading from the receiver. After that, simply readjust (increase) the signal generator's RF output so that the NDM is reading a level of 12dB below the reference — or in effect, a reading of 25% distortion. The signal generator's output level (in microvolts) is now the '12dB SINAD' sensitivity figure for this receiver — a threshold level for what is deemed to be 'intelligible reception'.

Note that at this point the NDM's reference reading may have changed, so you should repeat the calibrate procedure then the filter tuning step, until you reach a consistent SINAD figure. Also note that the frequency of the RF generator's internal modulation tone (1kHz) may not lie within the adjustment range of the NDM's notch filter tuning control ('Fine'), so you may need to connect the instrument's own reference oscillator to the external modulation input of the signal generator. With this arrangement the NDM's own 1kHz test tone will now modulate the RF signal, and the notch filter's tuning point will suit the frequency of the demodulated signal.

Construction Project — enhancement/mod:

PC Interface for DSE's Teletext Decoder

As promised, here's how to interface the Dick Smith Teletext decoder to an IBM-compatible personal computer. It can be done remarkably easily and at very low cost, by tapping into the I²C bus lines between the decoder's teletext and CPU chips. This technique may also be feasible with other Teletext decoders, as well.

by PETER PHILLIPS and JOHN ZERVOS

The interface circuit described here was developed by Mark van der Eynden and suits the Dick Smith Teletext decoder described in the June and July 1989 editions of *EA*. However, because this decoder uses the I²C bus, Mark's interface will probably work with other Teletext decoders that also use this bus. We'll have more to say about the I²C bus later, as it's a standard being used in quite a few applications.

The interface involves breaking into the I²C communications bus between the main Teletext decoder IC (IC4) and the 68705P3 microprocessor (IC8). The data is routed to the computer via a parallel port, under control of the computer. So obviously you need software to make the interface work, but that's all taken care of as you'll see.

The circuit

The circuit to interface the decoder to an IBM style computer is shown in Fig.1. As you can see, it couldn't be much simpler. The connections between IC4 and IC8 form the I²C bus and the quad CMOS bilateral switches of ICX tap into this bus and connect it to a parallel printer port on the computer.

When the computer is not controlling the interface, the 2.2k pull-up resistor connected to pins 12 and 13 will hold the switches of ICXa and d closed, allowing normal operation of the decoder. Otherwise, data is read to or from the I²C bus via bilateral switches ICXb and c, through the printer port of the computer. The parallel port pins have been chosen as those that are bi-directional on most IBM compatible computers. These days, all parallel port pins are bi-directional, unlike those on XT's where only some pins had this capability.

Incidentally, the reason for this lies in the power-up test that occurs when the computer is first switched on. The IBM PC was the first PC to have such a test, as it makes sense to use the microprocessor to find hardware problems; something IBM mainframes had been doing for years before.

But how do you test a printer port? Simple — at the end of each output bit you put another circuit which leads the bit back into the computer. So if there's an open-circuit the bit won't make it. On the IBM PC's printer port, the four output control lines are open-collector, and the eight data lines are three-state. This means any of the control lines are bi-directional.

It's not possible to give a full explanation of the operation of the interface circuit, as it relies more on software than hardware. However, a brief look at the I²C bus might be useful.

The I²C bus

The I²C bus is a two-wire, serial data interface developed to allow various ICs on a printed circuit board to communicate with each other. While data transfer speed is slower than a parallel system (limited to about 100kbps), it is simpler to implement as less wires (or PCB tracks) are needed.

However, ICs communicating with each other on a serial bus must have some form of protocol which avoids any likelihood of bus contention, data loss and blockage of information. Fast ICs must be

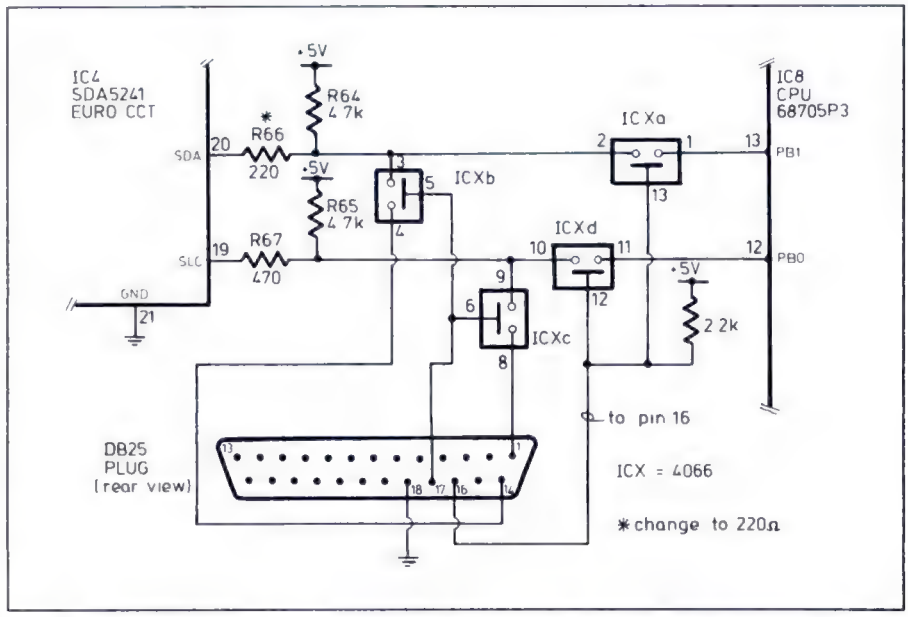


Fig.1: The interface circuit between the decoder and an IBM computer. Four bilateral switches link the I²C bus in the decoder to the PC, via a parallel port.

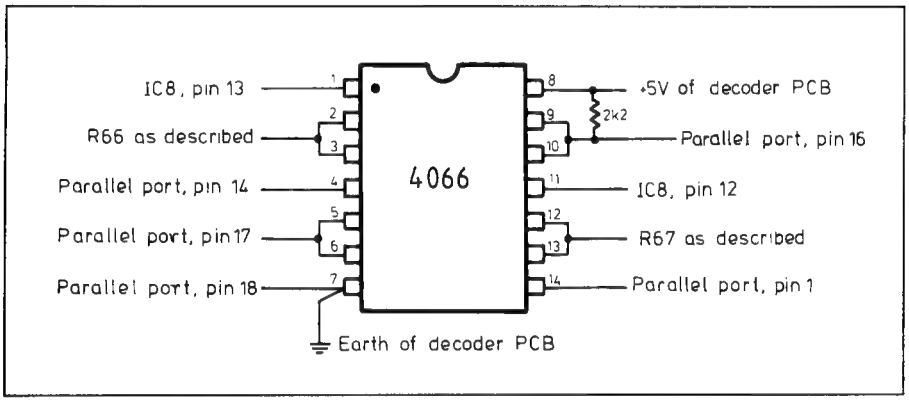


Fig.2: This diagram shows the connections to each pin of the 4066 quad bilateral switch. Note the pull-up resistor from pins 12 and 13, and the ground connection at pin 7.

able to communicate with slow ICs. The system must be independent of the type of ICs used, otherwise changes to the circuit would be impossible. A process to decide which IC is in control of the bus, and when, is also essential. And if ICs with different clock speeds are used, the bus clock source needs to be defined.

The I²C bus system meets all these criteria. There are two lines, serial data (SDA) and serial clock (SCL), which carry information between the ICs connected to the bus. Each IC is recognised by a unique address, and can operate as either a transmitter or receiver, depending on the function of the IC.

ICs are also either masters or slaves when transferring data. A master is an IC that initiates a transfer, generates clock signals and terminates a transfer. A slave is an IC addressed by a master. Therefore, each master generates its own clock. If two or more masters try to use the bus, the first to produce a 'one' when another produces a 'zero' loses the arbitration.

Arbitration is the procedure to ensure that if more than one master simultaneously tries to control the bus, only one is allowed to do so and the message is not corrupted. Arbitration takes place on the SDA line so that the master which transmits a high, while another master is transmitting a low switches off its data output stage because the level on the bus doesn't correspond to its own level. Arbitration is quite complex and is an essential part of the system. However, because there are only two ICs in the Teletext decoder that use the bus, arbitration is not really an issue here.

Both the SDA and SCL lines are bi-directional. A line can be pulled low by an IC, but not high. That is, to allow the wired-AND connection, the output stage of all ICs using the bus can only have an active device from the output to ground (open-collector). A pull-up resistor is needed to pull the line high when all outputs connected to the line are in the open-circuit state. Therefore, when the bus is free, both lines will be high.

The data on the SDA line must be stable during the time the clock is high.

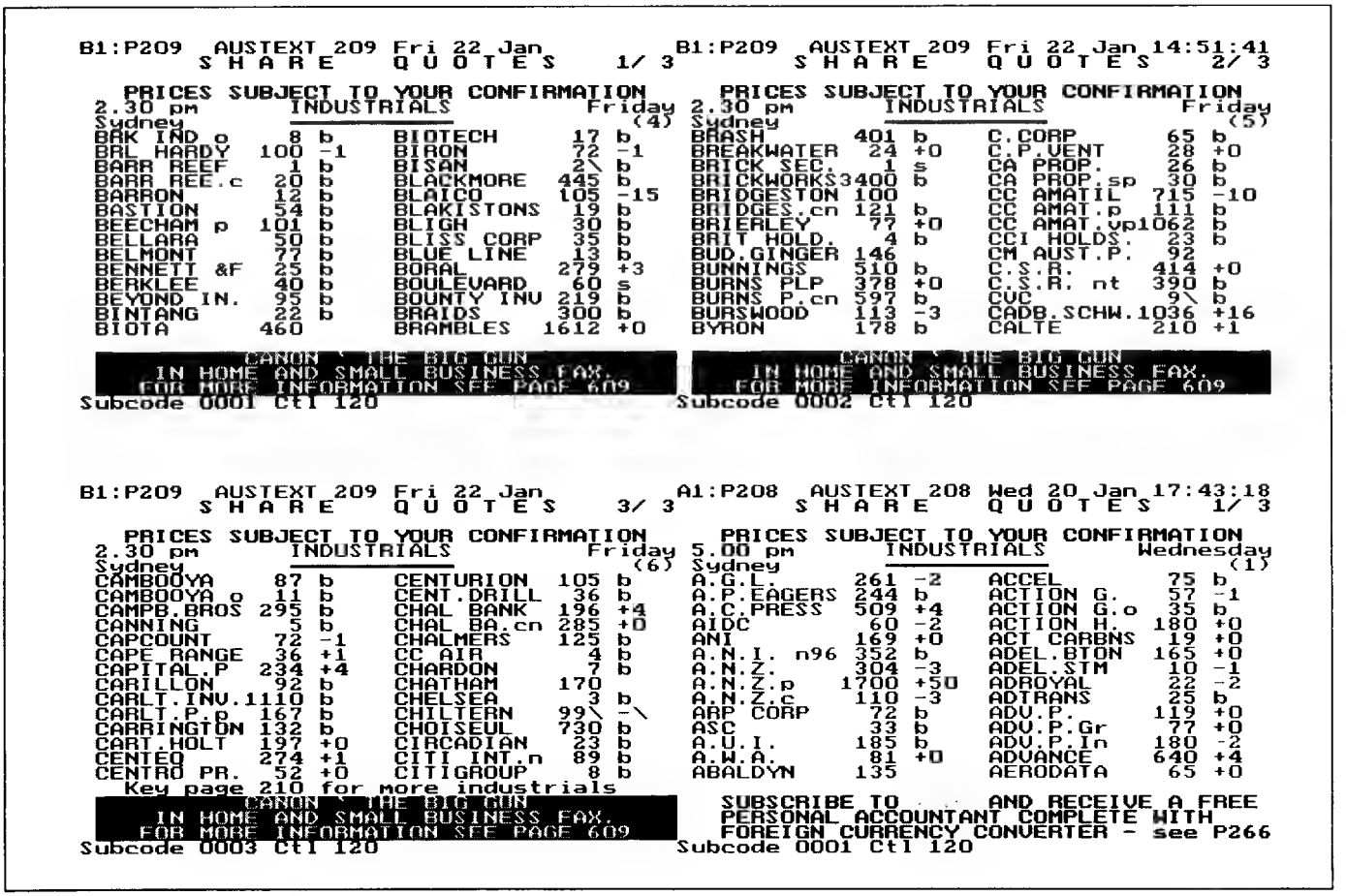


Fig.3: The TTDEMO program lets you view Teletext pages after capturing them. The display on the computer monitor looks like this, only in colour.

The data can change only when the clock line is low except for the two unique conditions that identify a start and a stop condition. A start condition is indicated when there's a high to low transition on the SDA line while the SCL line is high. A stop condition is defined as a low to high transition of the SDA line while the SCL line is high.

Every byte sent via the SDA line must be eight bits long. The number of bytes that can be transmitted per transfer is unlimited. However, each byte has to be followed by an acknowledge bit. Here, an acknowledge-related clock pulse is generated by the master, releasing the SDA line during this pulse.

The slave has to pull down the SDA line during the acknowledge clock pulse so that it remains low (and stable) during the high period of the clock pulse. When a slave receiver doesn't acknowledge (because it's busy performing a real-time function), the data line has to be left high by the slave. The master can then generate a stop condition to abort the transfer.

There's obviously a lot more to the system than we are presenting here, but this summary of the I²C bus might help you understand how it works.

Fitting the interface

Fitting the interface to the DSE Teletext unit is reasonably easy, as most of the connection points are available on the left side of the PCB, near IC4. Start by lifting R66 and R67 at the side that goes to IC8. Also, change R66 to 220 ohms (was 470 ohms). The lines that go to IC8 are the connections nearest the edge of the PCB.

You'll need a 14-pin DIL IC socket, preferably one with either wire-wrap connections or long pins able to accept soldered connections. The pin connections for the socket are shown in Fig.2. Use insulated telephone wire to make the connections between the socket and the decoder PCB. Incidentally, the two links next to the shield over the infrared sensor amplifier are +5V and ground. Don't forget to include the extra 2.2k resistor from pins 12-13 to the +5V supply at pin 14.

There are five wires from the interface to the parallel port of the computer. Connect these to the specified pins of a DB25 plug using a suitable lead. The 4-core shielded cable sold by Dick Smith Electronics is fine. A 5-pin DIN plug/socket combination at the Teletext end is also recommended.

When the interface is completed, but before it's connected to a computer, make sure the decoder still responds to the remote control unit. If so, it's unlikely anything is wrong. If not, it's probably because the I²C bus is not functioning. This could be due to a faulty 4066, or more likely a wiring error. For instance, make sure you haven't swapped the bus connections. Also check that pins 12 and 13 of the 4066 are at +5V, thereby closing the switches controlled by these pins.

(*Editor's Note: It would be a good idea to also fit a 10k resistor from pins 5 and 6 of ICX to ground, to ensure that these pins are pulled down to earth potential when there is no computer connected. This will help prevent ICX being damaged by electrostatic charge. The resistor could be fitted between pins 5-6 and 7.*)

```
* Simple Teletext Demonstration using the EXEC Interpretive Language
* By John Zervos January 1993
* Filename: TT-DEMO.EX2

&h0 = &string of ^M^CWelcome!!
&h1 = &string of ^EYou can write to the screen!
&h2 = &string of ^AIn any^Gcolour^Aand even^H^Bflashing!
&h3 = &string of ^GThis sample programme will search for
&h4 = &string of ^Gand display Teletext pages 100 and 120
&h5 = &string of ^G^H^MThat's it!!!!

&type
&type Look at your TV screen!

%teletxt init 1

%teletxt write a1 3 14 &h0
%teletxt write a1 7 1 &h1
%teletxt write a1 9 1 &h2
%teletxt write a1 15 1 &h3
%teletxt write a1 16 1 &h4

&del = 20
&call -delay
&del = 59

%teletxt search a1 100
%teletxt search b1 120
&call -delay

%teletxt display b1
&call -delay
%teletxt write b1 20 12 &h5

&exit 0

-delay
&timex = &time
&timehh = &piece of &time 1 2
&timemm = &piece of &time 4 2
&timess = &piece of &time 7 2
&timess = &timess + &del
&if &timess < 60 &goto -ready
&timess = &timess - 60
&timemm = &timemm + 1
&if &timemm < 60 &goto -ready
&timemm = &timemm < 60
&timehh = &timehh + 1
-ready
&timess = &right of 0&timess 2
&timemm = &right of 0&timemm 2
&timehh = &right of 0&timehh 2
&timex = &concat of &timehh : &timemm : &timess
&loop -loope while &timex < > &time
    -loope
&return
```

Fig.4: This program listing uses the EXEC interpreter. Use it to learn how to write your own programs.

The software

To make the system work, you'll need software. Mark has developed two packages to support the interface, and you can

purchase either or both of these from him as detailed at the end of the article.

If you aren't a programmer, you'll want the program TTDEMO.EXE. This program (which is written in PASCAL) lets you select Teletext pages to be saved to disk, view saved pages and so on. It has most of the facilities for general use, although it doesn't include all possible error handling routines. Therefore, under certain conditions, it may be unpredictable.

A typical display from this program is shown in Fig.3. As you can see, four Teletext pages are displayed on the screen. Three of these were captured on Friday, 22nd January, and the fourth (bottom right) two days earlier. While these show as a bit-mapped graphics image, they are actually four ASCII text files.

For programmers (even beginners), Mark has also developed a programming language called EXEC which includes built-in Teletext commands. These commands are used to transfer data between the computer and the Teletext decoder via the hardware interface described in this article.

If the thought of learning a programming language to get the most out of your Teletext interface is rather daunting, don't despair! EXEC is a simple to understand interpretive language. Readers who have played around with DOS batch-files on a PC will find writing EXEC programs a somewhat familiar experience.

EXEC files are developed on a text editor, such as the standard DOS editor, with each new statement occupying a separate line. As well as the Teletext commands (the focus of our discussion here), EXEC supports decision and flow-control statements, string manipulation, numerical manipulation, file input-output and error handling, to mention but a few.

EXEC files must be saved with a .EX2 file-name extension. For example, a Teletext demonstration program would have a file-name such as TT-DEMO.EX2. To execute that file, you need to type, at the DOS prompt: EXEC TT-DEMO. This calls up the EXEC program and instructs it to execute the file TT-DEMO.EX2 (note that the .EX2 extension is not required in the DOS command line). The EXEC program will then read the text file and interpret it at run-time.

Teletext commands

The EXEC Teletext command has several sub-functions allowing a fair amount of control over the Teletext decoder. Perhaps the heart of these is the SEARCH function, which informs the decoder to search for a particular Teletext page and store it in its memory. The standard Teletext decoder circuit fitted with a 6116 (2k x 8) SRAM chip is only able to store two Teletext pages in memory. This hardware limitation is therefore a consideration when writing EXEC programs.

The two areas in RAM where Teletext pages can be stored are referred to by EXEC as A1 and B1 (at least in our version of EXEC). Using the DISPLAY sub-function, the decoder can be told to display RAM areas A1 or B1 so you can switch between two saved Teletext pages. Further, the READ and WRITE sub-functions allow text and some graphics data to be read from or written to either of the saved pages in display areas A1 and B1. In a rather more complicated procedure, Teletext pages can even be saved to disk for later retrieval. Imagine coming home from work to find the latest Stock Market information already saved on disk for you!

PARTS LIST

Resistors

2 2.2k, 1/4W

Semiconductors

1 4066 quad CMOS bilateral switch

Miscellaneous

14-pin wire-wrap IC socket; DB25 plug; 5-core cable (or 4-core with shield); 5-pin DIN plug/socket; single strand insulated tinned copper wire (telephone wire).

NOTE:

Software as described in this article can be purchased from:
Mark van der Eynden
2/56 Ballantyne Street
Thornbury, Victoria 3071.
When ordering, please specify the size floppy disk (5.25" or 3.5" — preferred due to its robustness).
Cost is $10 for the demonstration program and read.me files. For $25 you also get the EXEC software, with text file describing the EXEC commands.

Sample program

We developed a simple EXEC program that writes a message to the TV screen via the Teletext decoder. The program then searches for Teletext pages 100 and 200 and displays each for about a minute before terminating. Simple, but not without its difficulties to accomplish.

For instance, there's the temptation to ask the decoder to store more than two pages at a time. This is not possible when it's only fitted with 2k bytes of RAM! Secondly, you can't ask the decoder to search for a Teletext page and expect it to be displayed immediately. It may take more than a minute to receive that page, so a software delay has to be introduced. Thirdly, make sure you have good Teletext reception. Poor reception can produce garbage on the screen, that can have you spending hours trying to fix a program bug that doesn't exist!

The listing for the demonstration program is shown in Fig.4. EXEC statements and variables have an ampersand (&) as the first character of the word, label names start with a hyphen and comment lines (which are skipped by EXEC) begin with an asterisk (*).

The first six lines of the TT-DEMO.EX2 program are used to define a set of strings. A string is a group of characters which in this case, are going to be displayed on the television screen via the Teletext decoder. Embedded in these strings are various control characters (preceded by the caret symbol ^) for setting the attributes of the text such as colour and flashing. Using the &TYPE statement, a message is then displayed on the computer screen to LOOK AT THE TELEVISION SET — after all, that's where the action will be!

The line %TELETXT INIT 1 tells EXEC to initialise parallel port 1 (LPT1) for interface with the Teletext decoder. If your printer is connected to LPT1 and you have a second parallel port, change the '1' to a '2' in this line.

Once the port has been initialised, the computer should be able to communicate with the Teletext decoder. Error checking has been left out of the program for the sake of simplicity, but EXEC provides this facility and should be used in more sophisticated programs.

Our program then writes a message to the screen via the Teletext decoder. Program line %TELETXT WRITE A1 3 14 &H0 tells EXEC to take string &H0 (which says "Welcome!!") and writes it at row 3, column 4 of the decoder's display area A1.

Once several messages are displayed on the television screen in this manner, the program then waits for about 20 seconds before searching for the Teletext pages. This allows the user time to read the screen. The 20-second delay is produced by setting the delay variable &DEL to 20 and calling the delay subroutine with the line &CALL - DELAY. A subroutine is a stand-alone program module which can be used over and over again. This saves having to rewrite it many times. The subroutine itself is quite complicated and is discussed later.

The delay variable &DEL is then set to 59 so that all subsequent calls to the delay subroutine will be for 59 seconds. This is an arbitrary value that we found works well in terms of allowing the decoder enough time to receive the required page.

Continued on page 81

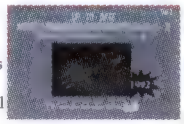
CD Cleaner

We are clearing out our CD Cleaners. These cleaners use the correct motion for removing small surface scratches and general dirt and grime.

A 9220 NORMALLY $17.95

This Month Only $7.95 *Save Over 50%*

Up-to-Date Worlds Transistor, Diodes, Thyristor IC's Comparison Table Books



These extremely compact books gives a brief description, specifications as well as equivalents for transistors, diodes, thyristors and IC's. Excellent reference books for professionals and hobbyists alike. Each contains hundreds of pages with thousands of components.

B 1270 Transistors, Diodes, Thyristors & IC's **$19.95**

B 1275 A - Z Transistors **$18.95**

B 1280 O - μ Transistors **$18.95**

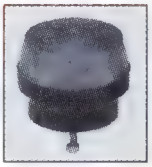
Ideal Reference Books for the Hobbyist & Professional Buy All 3 for $49.95 & SAVE!

13.8V 1A UPS

Designed for critical applications where it is important that products remain operational during mains failure, this UPS (Uninterruptible Power Supply) will supply 12V at 1.2 Amps via its internal inbuilt sealed lead acid battery even when the mains has failed. Ideal for use with alarm systems etc.

M 9090 $69.95

Mini Strobe Signal Lamps



New weatherproof design ideally suited to outdoor applications. Blue lens. 1 watt output. Uses Xenon tube for high energy flash. Flash rate approx 75 per minute. 12V DC 150mA. Dimensions: 70Ø x 53h mm.

S 5445 $19.50 *Fully Weatherproof*

Passive Infra-Red Movement Detector

Incorporates Pulse Count Triggering

Using the latest technology this compact Passive Infra Red Detector (P.I.R.) features Pulse Count Triggering which virtually eliminates false alarms.

S 5302 Normally $62.50,

This month Only $49.00 *Super Small! Suits S 5485 Panel Opposite*

D25 Computer Plugs & Sockets

Save Up To 20%

Standard Solder Pins

	Was	Ea This Month	Ea 10up
P 3000 9 Pin Male	$1.50	$1.35	$1.20
P 3010 9 Pin Female	$1.50	$1.35	$1.20
P 3100 15 Pin Male	$1.75	$1.60	$1.40
P 3110 15 Pin Female	$1.75	$1.60	$1.40
P 3200 25 Pin Male	$1.95	$1.75	$1.60
P 3210 25 Pin Female	$1.95	$1.75	$1.60
P 3070 15 Pin D9 Male	$4.35	$3.95	$3.50
P 3080 15 Pin D9 Femle	$4.35	$3.95	$3.50

Back Shell Covers

	Was	Ea This Month	Ea 10up
P 3090 9 Pin	$1.95	$1.80	$1.60
P 3190 15 Pin	$2.20	$1.95	$1.80
P 3290 25 Pin	$2.50	$2.20	$2.00

Spacer Screw Packs

	Was	Ea This Month
P 3310 Pack 10 Sets	$4.95	$4.15
P 3312 Pack 100 Sets	$39.95	$34.95

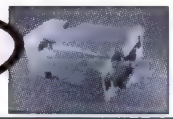
Right Angle PCB Mount

	Was	Ea This Month	Ea 10up
P 3020 9 Pin Male	$2.25	$2.00	$1.80
P 3030 9 Pin Female	$2.25	$2.00	$1.80
P 3120 15 Pin Male	$2.50	$2.25	$2.00
P 3130 15 Pin Female	$2.50	$2.25	$2.00
P 3220 25 Pin Male	$2.95	$2.65	$2.40
P 3230 25 Pin Female	$2.95	$2.65	$2.40

Straight Pins PCB Mount

	Was	Ea This Month	Ea 10up
P 3040 9 Pin Male	$1.95	$1.75	$1.60
P 3050 9 Pin Female	$1.95	$1.75	$1.60
P 3140 15 Pin Male	$2.10	$1.90	$1.70
P 3150 15 Pin Female	$2.10	$1.90	$1.70
P 3240 25 Pin Male	$2.50	$2.25	$2.00

All Connectors Gold Plated. - As Supplied to Manufacturers Across Australia



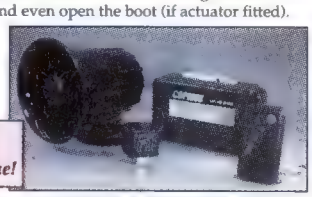
Passive Infra-Red Lite Aide Floodlight Control

How often have you thought there could be a prowler outside your door? Install a Lite Aide and (once armed) any "guest" will be floodlit when detected by this highly sensitive Infra-Red Detector. The Light Aide detects a moving person or vehicle by comparing the background temperature with a rapid change of temperature across the detection beams. So when Lite Aide detects movement across the coverage area, it will turn on the floodlight(s) for 10 seconds to 15 minutes as pre-adjusted.

S 5350 Was $49.95, Now Only **$39.95** *Cheap Security!*

High-Tech Remote Car Alarm

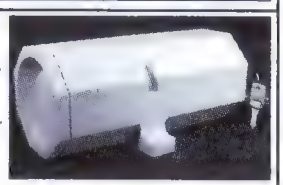
This amazing model features just about everything you could imagine! Multi-function keyring remote control will arm and disarm alarm (and activate central locking if fitted), chirp the horn, turn on the car headlights, panic and even open the boot (if actuator fitted). One remote can control two alarms (in two cars). Other features include starter inhibit, valet mode, central locking interface, flashes car indicators when tripped, auto reset, user programmable options plus much more.



S 5230 Normally $249.00

This Month Only $199.00 *$50 Off Amazing Value!*

Satellite Siren

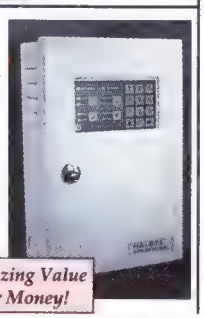


Connects easily into most car or house alarm systems. This self contained compact unit delivers a massive 120dB of deafening sound pressure once activated. It connects simply via 3 wires to any alarm system (car or house) that has an output that is normally negative (or low). When the alarm system is activated and the output goes positive (or high) the siren will sound. The siren will also operate if the wires to it are cut. Hence it adds extra security to your system if someone tampers with it to disable it. Simply armed and disarmed via inbuilt key switch.

S 5235 Normally $69.95

This Month Only $59.95 *Suitable for Most House or Car Alarms*

4 Sector Alarm Control Panel



For Commercial and Residential Premises. 4 independent sections accept N.O. and N.C. sensors. Any sector can be individually isolated, (e.g. when at home you may want to turn on perimeter sensors, allowing movement inside). User selectable 4 digit pin number allows you to arm and dis-arm the alarm via digital keypad. Sector 1 - 24 hour (Panic and Tamper), Sector 2 - Instant, Sector 3 - Hand-over Feature, Sector 4 - Delayed. Features dual intelligent siren drivers (i.e. if one speaker wire is cut the other will sound). Constructed in sturdy steel case. Requires 1.2Ah gell cell for battery back-up (S 5065), 16V AC plug pack (M 9025) and 8 ohm horn speakers (C 2015).

S 5485 Normally $249.00, **This Month Only $199.00** *Amazing Value for Money!*

Plug Packs

Our range of adaptors are each fitted with a 1.8M lead, in line socket and M 9014 2.5mm DC connector (different adaptor plugs available as below). Simple polarity setting. All energy authority approved.

Cat. No.	Output Voltage(s)	Max. Current	Price
M 9000	3, 4.5, 6, 7.5, 9, 12 DC	300mA	$19.95
M 9002	12V DC	300mA	$15.95
M 9004	9V DC	300mA	$15.95
M 9005	6, 9, 12V DC	500mA	$22.50
M 9022	12V DC	1A	$24.95
M 9027	16V AC	1.5 Amp	$29.95

Adaptor Plugs to Suit

M 9013 2.1mm DC Plug **$1.95**

M 9014 2.5mm DC Plug **$1.95**

M 9015 3.5mm DC Plug **$1.95**

12V Lead Acid Backup Batteries

Premium grade long life. Sealed lead acid batteries. Ideally suited for security alarm panels. Dimensions listed in mm and height does not include connection tabs.

S 5065 1.2AH	$29.95	42W	50H	96L
S 5067 3AH	$44.95	67W	60H	132L
S 5069 4AH	$49.95	68W	100H	90L
S 5070 6.5AH	$54.95	65W	100H	90L

Gell Cell Charger

Charging current 300mA at 12V. Includes red and black colour coded spade terminals for easy connection to most gel cell batteries.

M 8020 $12.50 *Ideally Suits Above Lead Acid Batteries*

Protect your Home or Business from Intruders With One of These "State of the Art" Burglar Alarm Security Systems

Economy 3 Sector Alarm Panel

Features:

• 3 Independent Protection Sectors • All Sectors are Compatible with N.O. and N.C. Switches • All Sectors are Sealed with End of Line Resistors • Adjustable Timers for Entry Delay and Siren Duration • Built-in Siren Driver • Output Relay is Selectable for 'Latch' or 'Timing' Operation • Remote Arming and Disarming Control Possible • Remote and Local Alarm Status Indication • Key operated arm and disarm • Requires 16 Volts AC M 9025 Plugpack, and Battery Backup S 5065-7 (Not Supplied)

S 5480 Normally $159.00,

This Month Only $147.50

Ideal for Homes & Small Commercial Premises!

ALTRONIC COMPONENTS

PHONE ORDER - FREECALL 008 999 007

ALTRONIC COMPONENTS

Aviation Headset

1000's Sold Across Australia - Includes 2 Year Warranty!

It was not to long ago when spending $450.00 on an Aviation Headset was not uncommon. Altronics changed all that when we released our C 9070 Aviation Headset for under $189.00. Now with the edition of the flexible boom unit and helicopter version (fitted with a Nato plug) our headsets have gone from strength to strength. Add to this enhanced microphone, improved lead shielding and headband comfort these headsets must be the best value for money in Australia!

C 9070 Standard Model **$189.00**

C 9073 New Flexible Boom Model **$225.00**

C 9072 New Helicopter Model **$249.00**

Aviation Push-to-Talk Switches

Includes quality velcro strap and simple push-button operation

C 9090 **$29.95**

Weather Proof Sound Monitors and Sound Columns

Amazing Performance at a Fraction of the Price of Some Other Imported Brands!

Ideal for Hi-Fi extension, surround sound or outdoor use.

Features: • Rugged extruded aluminium construction • Superb black or white industrial grade powder coat paint finish • Engineer designed in Australia • Excellent reproduction • Superior to imports - yet a fraction of the price • All exterior fixings marine grade stainless steel • Speaker cones treated with special formula to repel moisture

16 ohm 10 Watt			8 ohm 20 Watt		
C 0938 White	$115.00	each	C 0944 White	$149.00	each
C 0940 Black	$220.00	per pair	C 0943 Black	$280.00	per pair

300 Watt Inverter

This nifty inverter converts 12 Volts DC to 240 Volts AC. Includes an on/off switch and a light & heavy load switch with metered output. Works well with most electrical equipment.

M 8120 NORMALLY $249.00

This Month Only $199.00

Fantastic for Camping, Farmers etc. Save 20%

Micron Soldering Station

Electronic Temperature Controlled, Temperature Selectable, Soldering Station

Features variable temperature control, LED bargraph temperature readout, quality silicon lead, light weight handle sponge tray, and super heavy duty iron clad tips etc. Range of tip sizes available.

T 2440 $169.95

This Month $149

Suits Hobbyists and Professionals Alike!

Multi-Purpose Electrical Tester

This fantastic gadget will test a myriad of electrical and electronic components. It is simple to operate and is sure to amaze you with it's uses. Best of all, it's priced to make it a must for every technician, electrician and enthusiast. Tests continuity/resistance (100MΩ, 50MΩ and 5MΩ ranges), with buzzer and/or LED indication. Dead easy to use. Will check fuses, light bulbs, wiring, elements, speakers, diodes/LEDS, transistors, transformers and the list is endless.

Q 1250 Amazing Low Price **$17.95**

Pocket Sized Audio Signal Generator

This pocket sized oscillator has many of the features of a large bench oscillator. 46 preset switched frequencies ranged from 20Hz to 150kHz eg 1kHz, 1.2kHz, 1.5kHz, 1.8kHz, 2kHz etc. Smaller than most multimeters. Requires 9V battery (not supplied).

Q 1542 **$125.00**

Fantastic for On-Site Audio Service Work

Digital Voltmeter

This well designed LCD module will take care of most of your requirements of digital voltmeter displays. Voltage range and decimal place options are easily configured by PCB links. Small, compact, reliable and comes complete with plastic surround to give a professional finish

Specifications:

Digits: .....3.5, 13mm Height
Ranges:....200mV, 2V, 20V, 200V, 1000V DC
Input Impedance:.....10MΩ
Power Supply: .....9V DC
Over-range Indicator: .. . . . '1'
Decimal Place: .. . . . Variable
Accuracy: . . . . +/-0.5% (2 digit)

Ideal for Power Supplies Etc.

New From ALTRONICS

Q 0560 **$39.95**

Alphanumeric Dot Matrix LCD Module

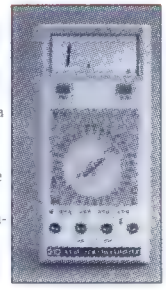
New

This compact LCD module has 96 inbuilt ASCII characters and 92 special letters which can be displayed on a 16 character by 2 line screen. The module will hold the current input on the display using its own built in memory, thus making it very easy to drive. Some possible applications could be within fax machines, measuring instruments, telephone applications or any other area where machine user feedback is required.

Z 7299 **$35.00**

This Module can be Programmed for Personalised Messages for Your Car, Alarm System etc. etc.

Digital Multimeter & LCR Meter



This digital meter tests in addition to standard multimeter ranges, capacitance and inductance, enabling you to test a wide variety of components. Indispensable for the design engineer, technician and enthusiast alike.

Q 1062 **$149.00**

Includes Carry Case

Universal Multimeter Carry Case Q 1052

Excellent padded vinyl case with zipper. Suitable for all meters advertised this month.

Free With Each Multimeter Ordered this Month

24 Range Digital Multimeter

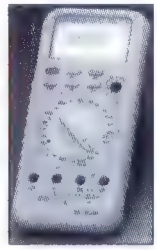
Features 1% Accuracy and Massive 20A Current Check. 3.5 digit. Ranges include AC & DC voltage, AC & DC current, resistance, diode check, transistor check etc this meter would have to be one of the best value multimeters available today

Q 1030 **$99.00**

New

Q 1040 Protective Holster to Suit **$15.95**

24 Range Digital Multimeter



With Frequency Measurement and Capacitance Meter. Includes frequency and capacitance ranges. With the addition of a built in logic probe and screen hold button it would have to one of the most useful DMM's available today

Q 1035 **$169.00**

Q 1040 Protective Holster to Suit **$15.95**

New

Auto Ranging 3.75 Digit Digital Multimeter

Triple LCD Display Includes 2 Digital & 1 Bar Graph. This incredible multimeter would have to be one of the most comprehensive on the market today. It is capable of doing all the normal voltage, current and resistance readings, as well as capacitance, frequency, minimum and maximum sampling, relating measurements, storing previous readings, limit setting, signal transistor gain checking and is full auto-ranging.

Q 1038 **$199.00**

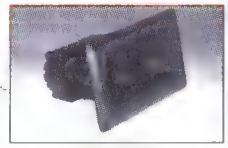
New From ALTRONICS

Q 1040 Protective Holster to Suit **$15.95**

PHONE ORDER - FREECALL 008 999 007

Motorola KSN1177A Piezo Twin Tweeter

New Twin Drive bullet provides outstanding acoustic performance. Rated to 100 Watts.

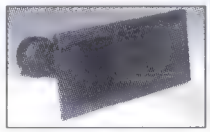


C 6170 **$39.95** New

Ideal Replacement Tweeter, or for That High Power Speaker Project! Piezo Design Means no Crossover is Required - Virtually Indestructible

Motorola KSN1151A/1142A

Horn part no. KSN1151A, driver part no. KSN1142A. Piezo Horn speaker suited to Hi Fi, PA and sound reinforcement. With built-in protection.



Dimensions:.....265 x 110mm
Frequency Response: ....1.8kHz - 30kHz
SPL:.....92dB (2.83V/1m)
Rated Power Input:.....75w nom, 400w max

C 6155 **$90.00**

Used Extensively in Professional Live Sound Stage Systems Throughout the World

Polypropylene Speakers

Amazing 40% Off!

These fantastic speakers are ideal replacement speakers or for your own speaker design Features extended bottom-end frequency response performance and cabinet size reductions for a given level of performance The lightweight plastic cones offer levels of performance above that of conventional cardboard cones. The cone is more rigid and does not "break-up" (flex) as much as its counterparts.

Cat No.	Size	Watts RMS	Watts Max	Was	This Month
C 3045	6.5" Midrange	30W	50W	$27.50	**$16.50**
C 3055	6.5" Woofer/Midrange	30W	50W	$29.95	**$17.95**
C 3060	8" Woofer	60W	100W	$49.95	**$29.95**
C 3065	10" Woofer	60W	100W	$69.00	**$41.40**
C 3070	12" Woofer	100W	150W	$99.00	**$59.40**
C 3075	15" Woofer	120W	200W	$129.00	**$77.40**

Suitable for home or commercial use, these fantastic rack frames are durable, strong, good looking, light weight and easy to assemble.

Save Hundreds of Dollars on Similar Custom Made Rackframes. Supplied in Kit Form, Assembles in Minutes!

Professional Rack Frames and Panel Sets

The frames are available in either natural (nat) anodised aluminium or Black Powder Coat aluminium and the side panels are either Horizon Blue or Black Powder Coat finish. Ideal for use in home Hi-Fi systems, professional audio installations, Band Gigs, Computer patch panels etc

H 5204	Rack frame 4U Nat	$139.00
H 5205	Panel set for H 5204	$49.00
H 5206	Rack frame 6U Nat	$149.00
H 5207	Panel set for H 5206	$55.00
H 5212	Rack frame 12U Nat	$169.00
H 5213	Panel set for H 5212	$89.00
H 5218	Rack frame 18U Nat	$189.00
H 5219	Panel set for H 5218	$110.00
H 5230	Rack frame 30U Nat	$229.00
H 5231	Panel set for H 5230	$159.00
H 5238	Rack frame 38U Nat	$269.00
H 5239	Panel set for H 5238	$195.00
H 5304	Rack frame 4U Black	$139.00
H 5305	Panel set for H 5304	$49.00
H 5306	Rack frame 6U Black	$149.00
H 5307	Panel set for H 5306	$55.00
H 5312	Rack frame 12U Black	$169.00
H 5313	Panel set for H 5312	$89.00
H 5318	Rack frame 18U Black	$189.00
H 5319	Panel set for H 5318	$110.00
H 5330	Rack frame 30U Black	$229.00
H 5331	Panel set for H 5330	$159.00
H 5338	Rack frame 38U Black	$269.00
H 5339	Panel set for H 5338	$195.00

Palm-Grip Series Hand Tools

Buy Both for $12 & Save!

A must for all tool boxes. Handy palm-grip size features spring return and stainless steel construction.
T 2710 Flat Nose Pliers
T 2720 Needle Nose Pliers

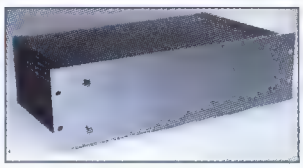
Normally $9.95 ea, **This Month $7.95 ea**

Switches

SPST chassis mount. With built in 240V AC Neon light.
S 3218 Normally $1.70

This Month Only .60¢ ea

High Energy Rack Case



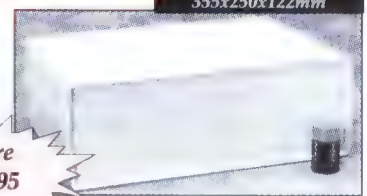
The use of heavy duty heatsinks as rack case sides now allows a myriad of amplifiers, power supplies, battery chargers etc, to be built in an "Off the Shelf" rack case. For very high heat dissipation this design allows the simple fitting of computer type fans to inside back of rear panel, adjacent to each respective heatsink. **Features:** • Uses Altronics H 0590 Heatsinks • Full Size 3 Unit Front Panel (480mm x 132mm x 3mm) • 1.0mm Steel Base, with Ventilation Slots • 1.0mm Steel Top Cover, with Ventilation Slots • Internal Dimensions: 125mm x 370mm x 250mm • External Dimensions: 130mm x 440mm x 252mm

H 0417 Natural Anodised Aluminium Front Panel
H 0418 Black Anodised Aluminium Front Panel

Both Normally $129.95, **This Month $110**

Super Large Instrument Cases

Massive 355x250x122mm



Designed to house amplifiers, inverters, power supplies micro-processor equipment etc. Built-in mounting posts for PCB's, transformers etc. Ventilated for efficient air-flow cooling. Extra tough, Super finish front and rear panels. Pictured battery for size comparison only.

H 0490 Case **$29.95**

Were $39.95

ALTRONICS
174 Roe St. Perth W.A. 6000
Phone (09) 328 1599, **Fax** (09) 328 4459
MAIL ORDERS C/- P.O. Box 8350
Stirling Street, PERTH W.A. 6849

STANDARD DELIVERY & PACKING CHARGE $3.50 to 500gms, $5.50 500gms -1 kg, $8 1kg-5kg **AUSTRALIA WIDE**-We process your order the day received and despatch via. Australia Post. Allow approx 9 days from day you post order to when you receive goods.

OVERNIGHT JETSERVICE Up to 3kg is $10.00, 3kg to 5kg is $23.00—We try to process your order the day received and despatch via. **Overnight Jetservice Courier** for delivery next day Country areas please allow additional 24-48 hours.

HEAVY HEAVY SERVICE-All orders of 10kgs or more must travel Express Road—Please allow 7 days for delivery. $12.00 to 10kgs. $15.00 over 10kgs.

INSURANCE-As with virtually every other Australian supplier, we send goods at consignee's risk. Should you require comprehensive insurance cover against loss or damage please add $1.00 per $100 of order value (minimum charge $1). When phone ordering please request "Insurance"

TOLL FREE PHONE ORDER-Bankcard, Visa, Mastercard Holders can phone order toll free up to 4pm Eastern Standard Time. Remember with our Overnight Jetservice we deliver next day.

ALTRONICS RESELLERS Chances are there is an Altronic Reseller right near you—check this list or phone us for details of the nearest dealer. Blue Ribbon Dealers are highlighted with a ● These dealers generally carry a comprehensive range of Altronic products and kits or will order any required item for you

WA - COUNTRY

ALBANY	BP Electronics ●	(098) 412681
	Micro Electronics	(098) 412077
BUNBURY	Micro Electronics	(097) 216222
ESPERANCE	Esperance Comm.	(090) 713344
MANDURAH	Forum Electronics	(09) 5813466
PORT HEDLAND	Ivan Tomek Electronics	(091) 732531
ROCKINGHAM	TV Joe's	(09) 5271806

NT

ALICE SPRINGS	Farmer Electronics	(089) 522388
DARWIN	Ventronics	(089) 853 622

VIC - CITY

	All Electronic Comp	(03) 6623506
	TECS	(03) 6706474
BORONIA	Ray Cross Electronics ●	(03) 7622422
CHELTENHAM	Talking Electronics	(03) 5842386
COLLINGWOOD	Truscott Electronics ●	(03) 4198208
CROYDON	Truscott Electronics ●	(03) 7233860
FOOTSCRAY	G.B. Telespares	(03) 3266035
PRESTON	Preston Electronics ●	(03) 4840191

COUNTRY

BAIRNSDALE	LH & LM Crawford	(051) 525677
BALLARAT	Ballarat Electronics	(053) 311947
BENDIGO	Sumner Electronics	(054) 431977
MILDURA	Pullman Auto	(050) 232882
SHEPPARTON	Andrew Guyatt Elect	(058) 219497
WARRNAMBOOL	Koroit Electronics	(055) 627417

QLD - CITY

	Delsound PL	(07) 8396155
WEST END	B.A.S. Audiotronics	(07) 8447566
WOODRIDGE	David Hall Elect ●	(07) 8082777

COUNTRY

GLADSTONE	Gladstone Elect. Services	(079) 724459
	Electronic Enterprises	(079) 726660
MAROOCHYDORE	Mals Electronics ●	(074) 436119
TOWNSVILLE	Super Solex ●	(077) 724466

SA - CITY

	Force Electronics ●	(08) 2125505
BRIGHTON	Force Electronics ●	(08) 3770512
CHRISTIES BEACH	Force Electronics ●	(08) 3823366
FINDON	Force Electronics ●	(08) 3471188
HOLDEN HILL	Force Electronics ●	(08) 2617088
LONSDALE	Force Electronics ●	(08) 3260901
ENFIELD	Aztronics ●	(08) 3496340

COUNTRY

WHYALLA	Eyre Electronics	(086) 454764

TAS

HOBART	George Harvey ●	(002) 342233
LAUNCESTON	George Harvey ●	(003) 316533

NSW - CITY

	A-One Electronics	(02) 2674819
	David Reid Elect. ●	(02) 2671385
SMITHFIELD	Chantronics	(02) 6097218

COUNTRY

COFFS HARBOUR	Coffs Habour Elect.	(066) 525684
NEWCASTLE	Novocastrian Elect.Supplies	(049) 621358
WARNERS BAY	Vilec Distributors	(049) 566792
WINDSOR	M & E Elect. and Comm.	(045) 775935
WOLLONGONG	Newtek Electronics ●	(042) 271620
	Vimcom Electronics	(042) 284400
WOY WOY	Alphatran Electronics	(043) 434919

PHONE ORDER - FREECALL 008 999 007

ALTRONIC COMPONENTS

Mini Construction Project:

RS-232C DATA MONITOR ADAPTOR FOR PC'S

A standard 'breakout box' will show you which lines of an RS-232C serial data link are positive, and which are negative — but it won't let you examine any data being transmitted along the link. Here's an easy to build, very low cost adaptor which will let you use virtually any standard PC as a serial data monitor. All the PC needs apart from the adaptor is a serial RS-232C port and almost any communications software.

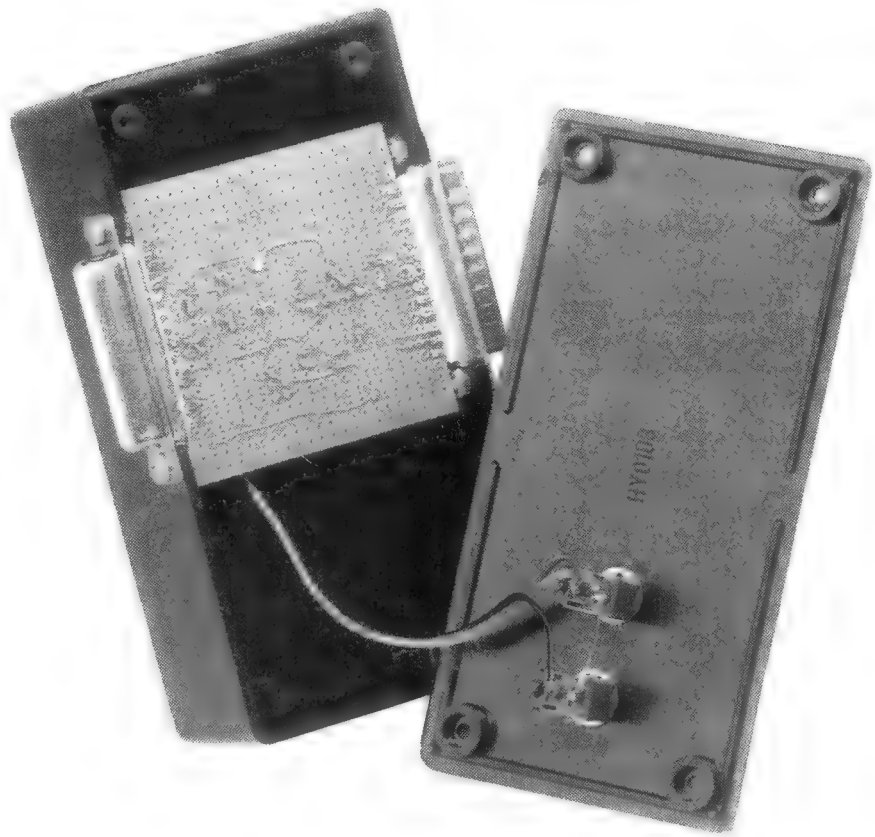
by PETER SIMMONDS

For all its apparent simplicity, RS-232 serial communications seems to pose more problems than would be expected. This is evident by the number of different types of 'breakout boxes', available for monitoring the state of RS-232 lines between two pieces of equipment such as TXD, RXD, CTS etc.

These breakout boxes are designed to assess whether the handshaking is correct, and whether the TXD and RXD lines should be crossed over or not for correct communications. Unfortunately they don't tell you what data is actually being *sent*, along the transmit and receive lines. A number of companies do produce pieces of communications analysis equipment, but these are quite often 'overkill' for what is required — and in many cases they are very expensive.

Most RS-232 communications setups are *half duplex* in nature. That is, unit A may transmit characters to unit B. Unit B on receiving the characters and decoding their purpose then prepares a response and transmits it back to Unit A. Unit A at this point of time has stopped transmitting and is listening for the response from B. Hence at any point in time only one unit is transmitting, while the other is listening.

I wanted a piece of equipment that I could insert into this type of communications link, to monitor the data being sent. The data monitor would then be connected to the serial port on my trusty laptop personal computer, running a common communications package like *Procomm*, *Mirror*, *Crosstalk* or *Telix*. I would then be able to observe the data that was being transmitted in either direction or both. If both directions were being observed, then it would have to be a half duplex type situation as described above.

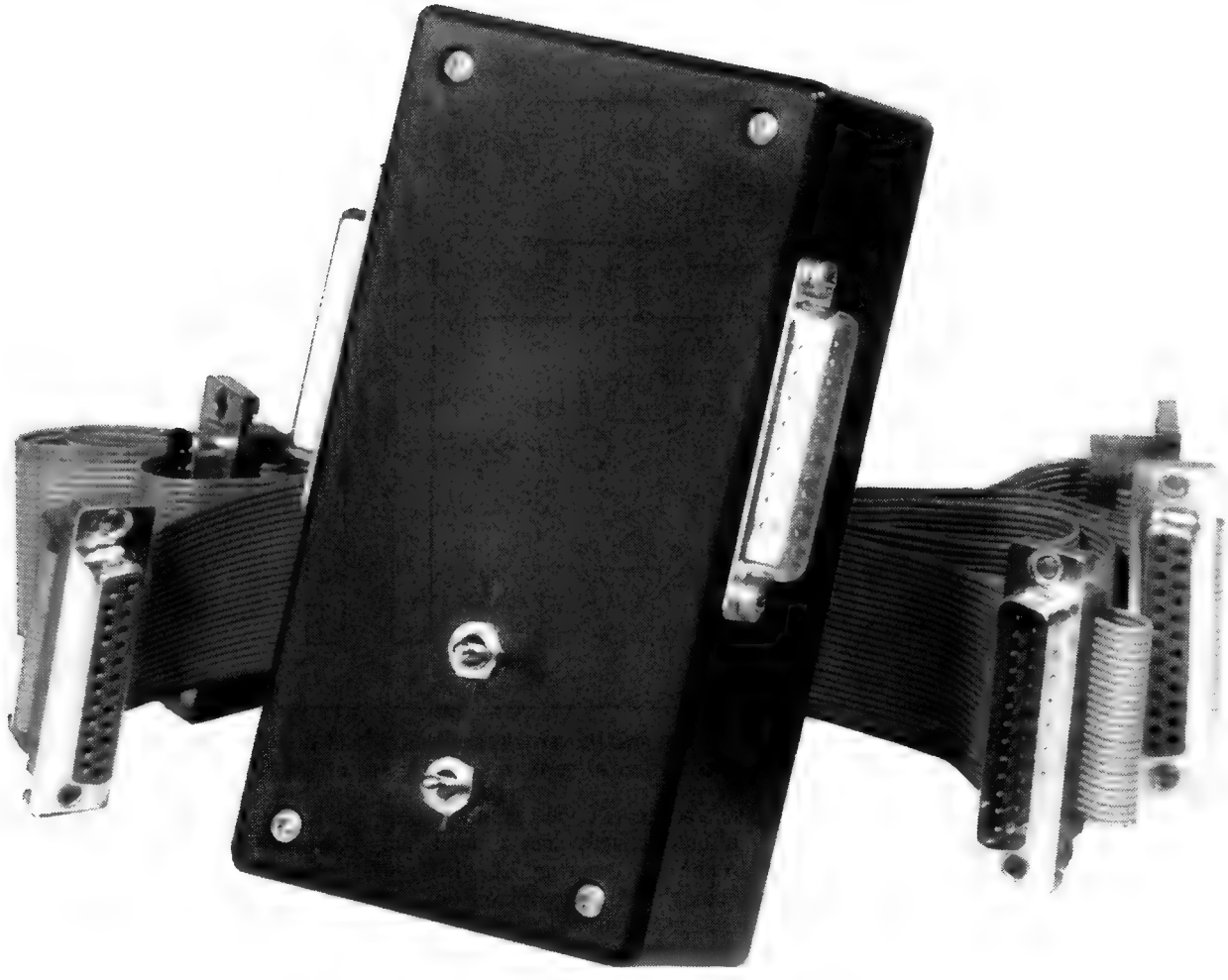


A view inside the author's prototype adaptor, which as you can see, was built up on utility board. The basic construction is the same as that used with the final PC board; however, note that the board is supported by the two DB25 connectors.

Along with this I had several other wishes. Firstly the equipment had to be very low powered, and preferably not powered from batteries as they have that unfortunate tendency of running down. It was from this requirement that I decided to power it from the handshake lines on the monitoring laptop's computer serial port.

Secondly because I deal with low power equipment such as datalogging units which have 0-5 volt levels on their transmission line, my piece of data monitoring equipment had to be able to cope with this type of 'modified RS-232' communications. Finally it had to operate with data rates of up to 19,200 baud.

(Note: If you are particularly interested in monitoring binary data which contains control characters, do not use



Procomm **or** *PC Plus* **software in the monitoring PC, because these filter out a lot of these characters and they will not register.)**

Powering the monitor

The RS-232C standard produced by the EIA stipulated that a receiver should be able to detect as a 'mark' a voltage in the range from -3V to -25V, while a 'space' was to be represented by a voltage between +3V and +25V. The RS-232 transmitting driver, though, should be able to provide a signal between -5V and -15V for a mark, and between +5V and +15V for a space, into a load resistance of between 3000 and 7000 ohms. This is summarised in Table 1.

Although there are 25 pins on the standard D-type connector used for RS-232C, less than half are used in the greater majority of situations. The commonly used pins are shown in Table 2.

TABLE 1

Notation	Interchange Voltage	
	negative	positive
Receiver	-25<V<-3 volts	3<V<25 volts
Transmit driver	-15<V<-5 volts	3<V<15 volts
Binary state	1	0
Signal condition	Mark	Space
Control function	off	on

The Data Communications Equipment or DCE is usually a modem, while the Data Terminal Equipment or DTE is usually a computer or a terminal. Table 2 shows that pins which are outputs on a DTE are inputs on the DCE and vice-versa. Table 2 also shows the voltage levels on the pins when transmission is ready to occur.

Because we are connecting our data monitor circuit to a computer which acts as a DTE, I realised that I could derive power for the data monitor circuit from the Request to Send (RTS) and Data Terminal Ready (DTR) pins of the PC used to monitor the data. These pins are usually at a voltage of between +5 and +15V when the DTE is ready to transmit characters. Because these drivers normally output a voltage close to +10V and are able to drive a load of 3000 ohms, the drivers can be expected to source at least 3mA each.

The circuitry

The circuit I evolved for the data monitor adaptor is relatively simple and is shown in Fig.1. The data receivers used to monitor the main RS-232C data lines are simply transistors Q1 and Q2, connected in a common emitter configuration. The voltage divider at the base of each transistor ensures that the switching threshold is 1.8V, which makes it suitable for both normal RS-232C signals and 0-5V 'modified RS-232' signals. The two collectors, which will fluctuate between 0.2 volts and the positive supply rail, are connected in a wired-AND arrangement.

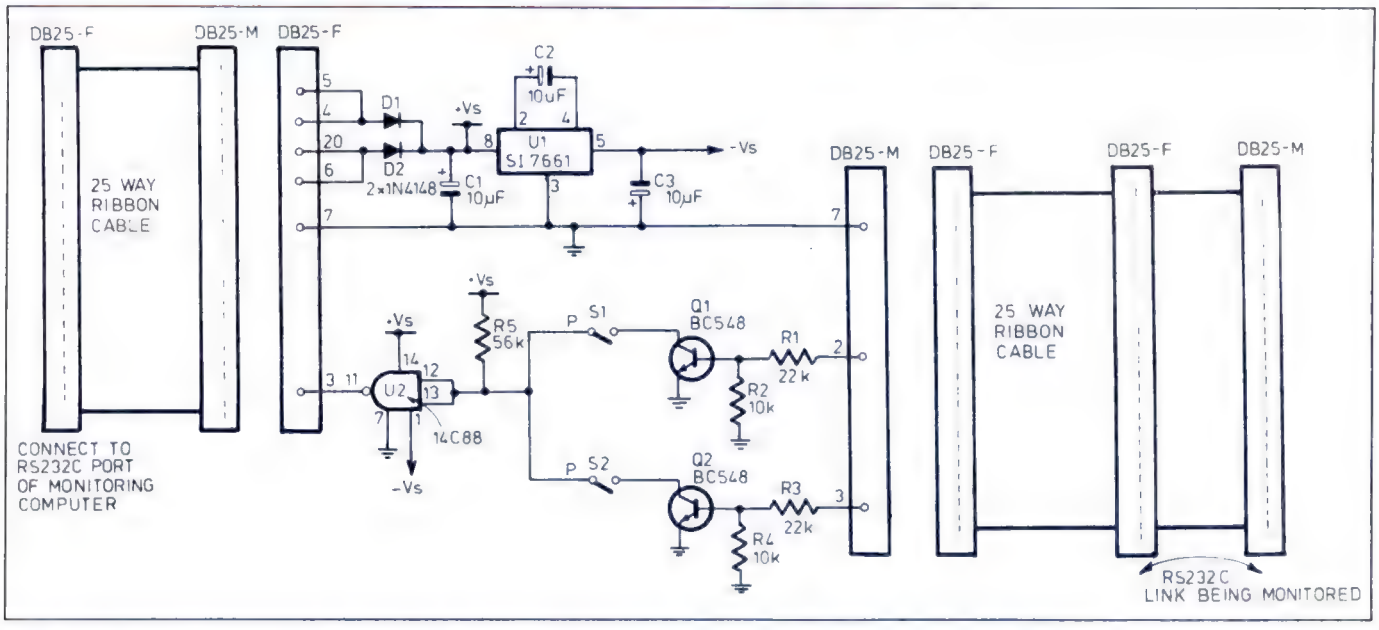
Switches S1 and S2 allow either line of the RS-232C link to be monitored or both. The ANDed output is then fed to an RS-232C driver of type 14C88, to feed the data back to the monitoring PC. The

TABLE 2

Name	Circuit Description	Pin No	DTE	DCE	Normal Level
SG	Signal Ground	7			0
TXD	Transmitted Data	2	O	I	-
RXD	Received Data	3	I	O	-
RTS	Request to Send	4	O	I	+
CTS	Clear to Send	5	I	O	+
DSR	Data Set Ready	6	I	O	+
DTR	Data Terminal Ready	20	O	I	+
DCD	Data Carrier Detect	8	I	O	+

(where O = Output, I = Input)

RS-232C Data Monitor Adaptor for PC's



This diagram shows both the schematic for the adaptor and the way it requires two 25-way ribbon cables to connect it both to the RS-232C link to be monitored (right), and the computer being used as the monitor (left).

14C88 is a CMOS version of the ubiquitous 1488 and as a result has very low power requirements. A pull-up resistor is needed at the input of the 14C88 gate to ensure that it is held positive if both switches are opened.

The unfortunate thing about the 14C88 driver is that it requires both a positive and negative supply voltage. The positive supply voltage is derived from the RTS and DTR pins.

Diodes D1 and D2 are connected to pins RTS and DTR (pins 4 and 20 respectively) which provide isolation between the pins and allow the passage of positive voltage to the circuit even if one of the pins does go negative. This supply voltage will usually be approximately 10V, but could be up to 15V.

The negative supply voltage is obtained by inverting this +10V supply using an inverter IC, type Si7661 (U1). Although the inverter type ICL7660 is more common, it unfortunately has a maximum limit to the input voltage of +10V — whereas the Si7661 from Siliconix has an input voltage range that can handle the +15V limit that a RS232 driver can provide. These inverters have an efficiency of approximately 90%, which means there is very little power wastage.

Construction

The circuit board is a single-sided one to limit costs. To house the circuit board I used a plastic Jiffy case measuring 67 x 130 x 42mm. Slots are cut in the sides to accommodate the two 25-pin D solder connectors.

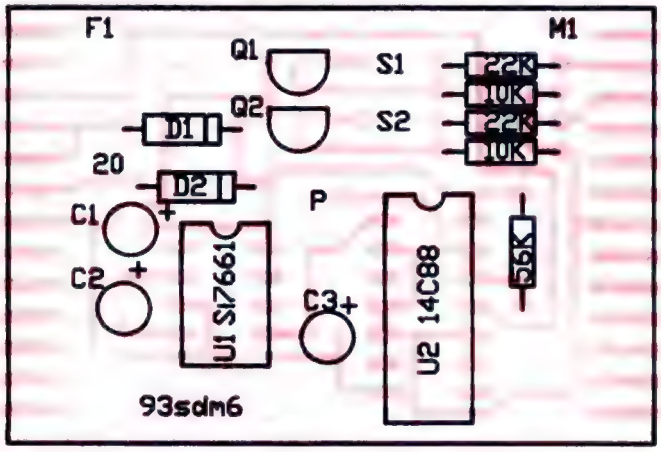
Solder the IC's and resistors into place on the circuit board. When soldering in the capacitors and the diodes, note their polarity. Finally insert the transistors, noting their proper orientation as well. Finally solder the three wires for the switches to the board.

Connect the male D-type connecter into place on the case using three 5mm screws. Push the circuit board in between two rows of pins on the connector, and align pin 1 with the pad marked 1M on the board. Now mount the female D connector on the other side of the box, with the circuit board again slipping in between the two rows of pins. Make sure pin 1 of this connector lines up with the pad marked 1F.

When the circuit board and connectors are in place, solder the pins 1 to 13 of both connectors onto the circuit board. Then turn the board over to the component side and solder a link from the female connector pin 20 to the hole marked 20.

Solder three wires to the circuit board at the locations P, S1 and S2. Now mount

Continued on page 98



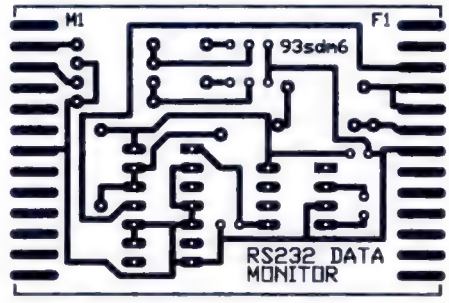


Fig.2 (above): The PCB pattern for the adaptor, shown actual size for those that like to etch their own boards.

Fig.3 (left): The PCB overlay diagram, showing where all the components are fitted.

NO BRAND DISKETTES

DESCRIPTION	PER BOX 1~9	10+
3.5 DSDD	$8.30	$7.75
3.5 DSHD	$13.95	$12.95
5.25 DSDD	$4.50	$4.30
5.25 DSHD	$8.30	$8.00

QUALITY

100% GUARANTEED

TECS

ACN 007 296 924

ELECTRONICS & COMPUTER SUPPLIERS

FLOPPY DRIVES

1.44M	$75.00
1.2M	$90.00

HARD DRIVES
(VOICE COIL)

40M IDE	$299.00
80M IDE	$395.00
100M IDE	$410.00
120M IDE	$425.00
200M IDE	$599.00

3.5 HDD BRACKET	$9.95
3.5 FDD BRACKET	$8.95
3.5 DATA ADAPTOR	$5.95
3.5 POWER ADAPT	$4.50
5.25 POWER Y-ADPT.	$4.95

MOTHERBOARDS

386SX-33	$195
386DX-40	$290
386DX-40 128K	$320
386DX-40 128K UPGRADABLE TO 486 & WITH 32-BIT LOCAL BUS	$420
486SX-33	$495
486SX-33 256K	$625
486DX-33 256K	$830
486DX2-50 256K	$1035
486DX-50 256K	$1375

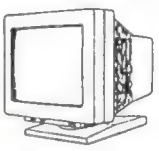
CO-PROCESSORS
UNIVERSAL SPEED 16~33MHz
25MHz ON SX CO-PRO

387SX INTEL	$185
387DX INTEL	$195

PERIPHERAL CARDS

XT CLOCK	$22.50
XT/AT SERIAL (1 POP.)	$19.50
XT/AT PARALLEL	$19.50
XT/AT GAMES	$19.50
AT MULTI I/O (2S,1P,1G)	$25.00
AT IDE/FDD	$22.50
AT IDE/FDD MULTI I/O	$45.00
MONO/CGA GRAPHICS	$45.00
512K TRIDENT VGA	$75.00
1M TRIDENT VGA	$110.00

MONITORS



14" SUPER VGA .28mm
NORMALLY $489
NOW $455

14" SVGA NON-INTERLACED
NORMALLY $645
NOW $575

15" XGA NON-INTERLACED
NORMALLY $795
NOW $775

KEYBOARD

101 KEY SUITS IBM CLONES
NORMALLY $49 SAVE $10
NOW $39

QUALITY MOUSE
AT ECONOMY PRICE!!

TRUEMOUSE
- THREE BUTTONS.
- SELECTABLE BETWEEN MOUSE SYTEMS & MICROSOFT
- UP TO 800 DPI.

NORMALLY $29.50 ***NOW $25***

COMPUTER CASES

FLIP-TOP	WERE $95 ***NOW $89***
MINI TOWER	WERE $120 ***NOW $115***
FULL TOWER	WERE $295 ***NOW $245***

MEMORY CHIPS

DRAM

41256	$2.95
44256	$8.50
411000	$8.50
1M SIM	$59.00
4M SIM	$245.00

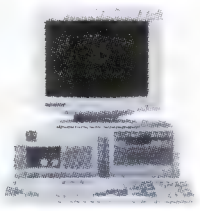
CACHE RAM
M5M5C2588-20 (32K) $19.50

COMPUTER SYSTEMS

386SX-33MHz	$1560
386DX-40MHz	$1675
386DX-40MHz 128K CACHE	$1695
386DX-40MHz 128K CACHE UPGRADABLE TO 486 / LOCAL BUS	$1800
486SX-33MHz	$1875
486SX-33MHz 256K CACHE	$1930
486DX-33MHz 256K CACHE	$2210
486DX2-50MHz 256K CACHE	$2415
486DX-50MHz 256K CACHE	$2550

ABOVE SYSTEMS INCLUDE:

4M RAM, 120M HDD,
1.2M FDD, 512K VGA,
SUPER VGA MONITOR,
2S/1P/1G PORTS,
101 KEYBOARD,
FLIP-TOP CASE,
200W PSU.
(CASE STYLE MAY VARY FROM THAT SHOWN)



SYSTEM OPTIONS:

EXTRA RAM	$55/MEG
1.44M FDD	$70
200M HDD IN LIEU OF 120M	$195
1M VGA CARD IN LIEU OF 512K	$30
NON-INTERLACED MONITOR IN LIEU	$100
MINI - TOWER CASE IN LIEU	$40
FULL - TOWER CASE IN LIEU	$120
MS-DOS 5.0	$80

N.B. : FREIGHT CHARGE ON SYSTEMS;
$10 FOR METROPOLITAN MELBOURNE.
$25 FOR COUNTRY VIC. & INTERSTATE.

STOP WASTING YOUR VALUABLE TIME

- EVEN ON A 486 MACHINE, FORMATTING 1.44M DISKS SEEMS TO TAKE FOREVER!!
- WE NOW STOCK **PRE-FORMATTED DISKETTES.**
- 100% ERROR FREE.
- AFFORDABLE PRICE.

3.5" 1.44M
$14.95 PER BOX OF 10

NEW

HEATSHRINK TUBES

-HIGH QUALITY, FLEXIBLE.
-AVAILABLE IN BLACK, RED, BLUE, WHITE, AND CLEAR.

1.6mm DIA. WERE$1.95	*NOW $1.50*
2.4mm DIA. WERE$2.25	*NOW $1.75*
3.2mm DIA. WERE$2.45	*NOW $1.90*
4.8mm DIA. WERE$2.85	*NOW $2.20*
6.4mm DIA. WERE$3.25	*NOW $2.50*
9.5mm DIA. WERE$3.65	*NOW $2.80*
12.7mm DIA. WERE$3.95	*NOW $3.00*
19.1mm DIA. WERE$5.95	*NOW $4.75*

NiCd BATTERIES

AAA 180mAH WERE $3.50	*NOW $3.15*
AA 500mAH WERE $2.95	*NOW $2.50*
AA 500mAH WITH TABS WERE $2.95	*NOW $2.60*
C 1.2AH WERE $6.50	*NOW $5.50*
C 1.8AH WERE $8.95	*NOW $7.50*
SUB C 1.7AH WERE $8.95	*NOW $7.50*
D 1.2AH WERE $8.50	*NOW $7.25*
D 4AH WERE$17.50	*NOW$15.00*
216 9V WERE$18.95	*NOW$16.00*

MONO TTL MONITOR

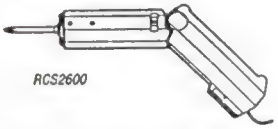
THESE ARE FAST BECOMING HARD TO FIND AS MORE AND MORE PEOPLE ARE SWITCHING TO VGA COLOUR MONITORS.
FEATURES:
- PAPER WHITE ON BLACK.
- 14" DISPLAY.
- H. FREQ. 15.75KHz AND 18.432KHz.
- V. FREQ. 47~63Hz.
- 20MHz BANDWIDTH.

$195.00

CORDLESS SCREWDRIVER

FEATURES:
- TORQUE ADJUSTMENTS.
- WALL BRACKET.
- 4 MAGNETIC BITS.

240V CHARGER INCLUDED.



RCS2600

$49.95

SEMICONDUCTORS
BUY IN BULK AND SAVE $$$'S!!!

	NORMAL UNIT PRICE	*SALE PRICE*
DIODES		
1N4148 (PK. 100)	$0.10	*$3.00*
1N4004 (PK. 100)	$0.10	*$6.00*
1N4007 (PK. 100)	$0.20	*$7.00*
1N5404 (PK. 100)	$0.30	*$14.00*
1N5408 (PK. 100)	$0.45	*$16.00*
LED'S		
3mm RED (PK. 100)	$0.20	*$10.00*
3mm GRN (PK. 100)	$0.30	*$15.00*
3mm YLW (PK. 100)	$0.30	*$15.00*
5mm RED (PK. 100)	$0.20	*$10.00*
5mm GRN (PK. 100)	$0.25	*$18.00*
5mm YLW (PK. 100)	$0.30	*$18.00*
TRANSISTORS		
BC547/8/9 (PK. 100)	$0.15	*$7.00*
BC557/8/9 (PK. 100)	$0.15	*$7.00*
IC'S		
555 (PK. 50)	$0.65	*$20.00*
741 (PK. 50)	$0.60	*$18.00*

PHOTO INTERRUPTERS
SHARP GP1A50HR

NEW
$3.95

HIGH CAPACITY EPROMS

27C020-15	256K X 8	$29.50
27C4096-15	256K X 16	$55.00
27C040-15	512K X 8	$49.50

NEW

OFFICE: 1ST FLR., 289 LATROBE ST., MELBOURNE, VIC. 3000
SHOP: GRD. FLR., 289 LATROBE ST., MELBOURNE, VIC. 3000
PHONE: (03)602-3499 FAX: (03)670-6006

MAIL ORDER HOTLINE
(008)335-901 TOLL FREE

ALL MAJOR CREDIT CARDS WELCOME

SHOP HOURS:

MON.~THURS.	:	8:30 ~ 5:30
FRI.	:	8:30 ~ 8:00
SAT.	:	9:00 ~ 1:30

Normal prices charged, unless ad prices quoted.
Errors & ommissions excepted.

POSTAGE RATES:

$1.00 ~ $9.99	$3.00
$10.00 ~ $24.99	$3.50
$25.00 ~ $49.99	$4.50
$50.00 ~ $99.99	$6.00
$100.00 ~ $199.99	$7.00
$200.00 ~ $499.99	$8.00
$500.00 PLUS	FREE

DOES NOT APPLY TO COMP. SYSTEMS

AUTOMOTIVE ELECTRONICS

with MAJOR AL YOUNGER (USAR, Ret.)

Ford's Electronic Engine Control System IV (EECIV)

No, that's not a badge change; if you own a late-model Ford with an ECU, you have this system. There are many variations, but the ECU architecture is the same. It's used on AFC (air flow control), CFI (central fuel injection), MPFI (multi-point fuel injection) and SEFI (sequential fuel injection) systems.

Up front, an important point to note about Ford's EECIV ECU's is that they're *not* interchangeable, except on an exact basis. The internal PROM is not removable, and an ECU for a car *without* air conditioning will not work correctly on a car *with* air conditioning. If you've fitted an after-market air conditioner, you now know why it stalls when the air is turned on!

The usual 'quick fix' for this to mechanically 'mickey mouse' the idle system, and that's where the trouble starts because idle is controlled by the ECU.

It's true that a 'sharp' auto tech *can* solve that problem and even successfully swap transmissions, from manual to auto or vice-versa. But I just wanted to let you all know that the EECIV's really "ain't all the same"...

The CFI configuration for the Ford EECIV system is shown in Fig.1. The EECIV system controls the following:

- Air Fuel Ratio (AFR)
- Timing (First Priority)
- Idle Speed
- Air Management
- Emissions
- Fuel Pump Operations
- Check Engine Lamp (CEL)
- Self-Test Diagnostics

Note that the engine ECU has a data link with the electronic controlled transmission's ECU.

The ECU is located on the passenger side, either under the instrument panel or behind the kick panel. On Falcons equipped with a BTR electronic automatic overdrive transmission, a separate Intel 10MHz ECU for the transmission is attached to the brake pedal support bracket. The diagnostic test leads are under the bonnet.

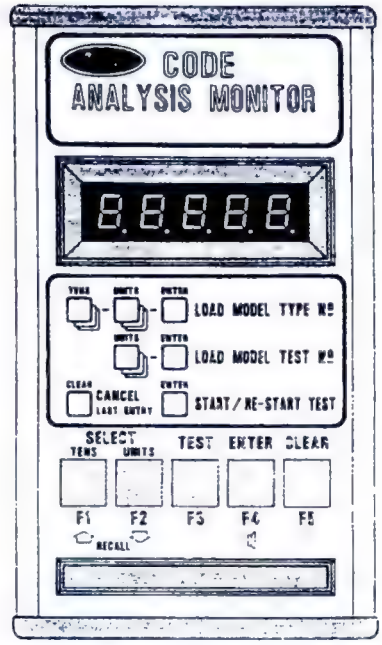


Fig.2: Ford's Code Analysis Monitor.

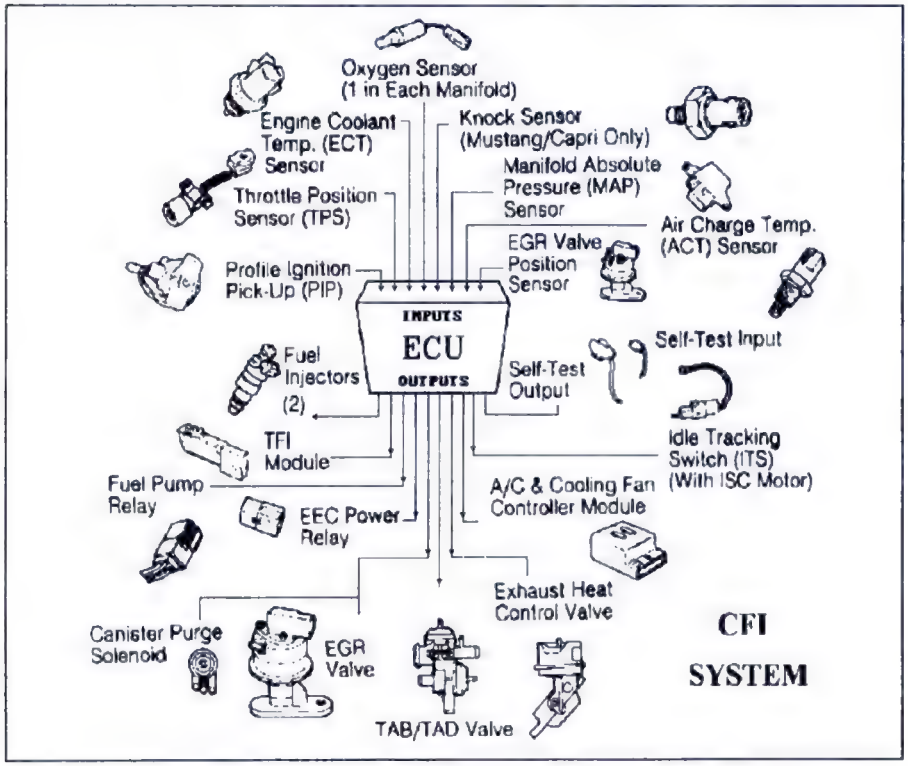


Fig.1: The CFI configuration for a Ford EECIV system, showing its I/O ports.

The ECU contains input conditioning circuits, calibrated memory, Keep Alive Memory (KAM), reference voltage sources, output drivers, diagnostic inputs/outputs and a central processor unit (CPU). The latest processor (EA Falcon 5L SEFI) is an Intel 15MHz, 16 bit device. Diagnostic information and adaptive strategy instructions (software) are stored in KAM. The engine operating instructions are retained in KAM with the ignition off, while the engine calibration is stored in a 32-48K EPROM, in lookup table format.

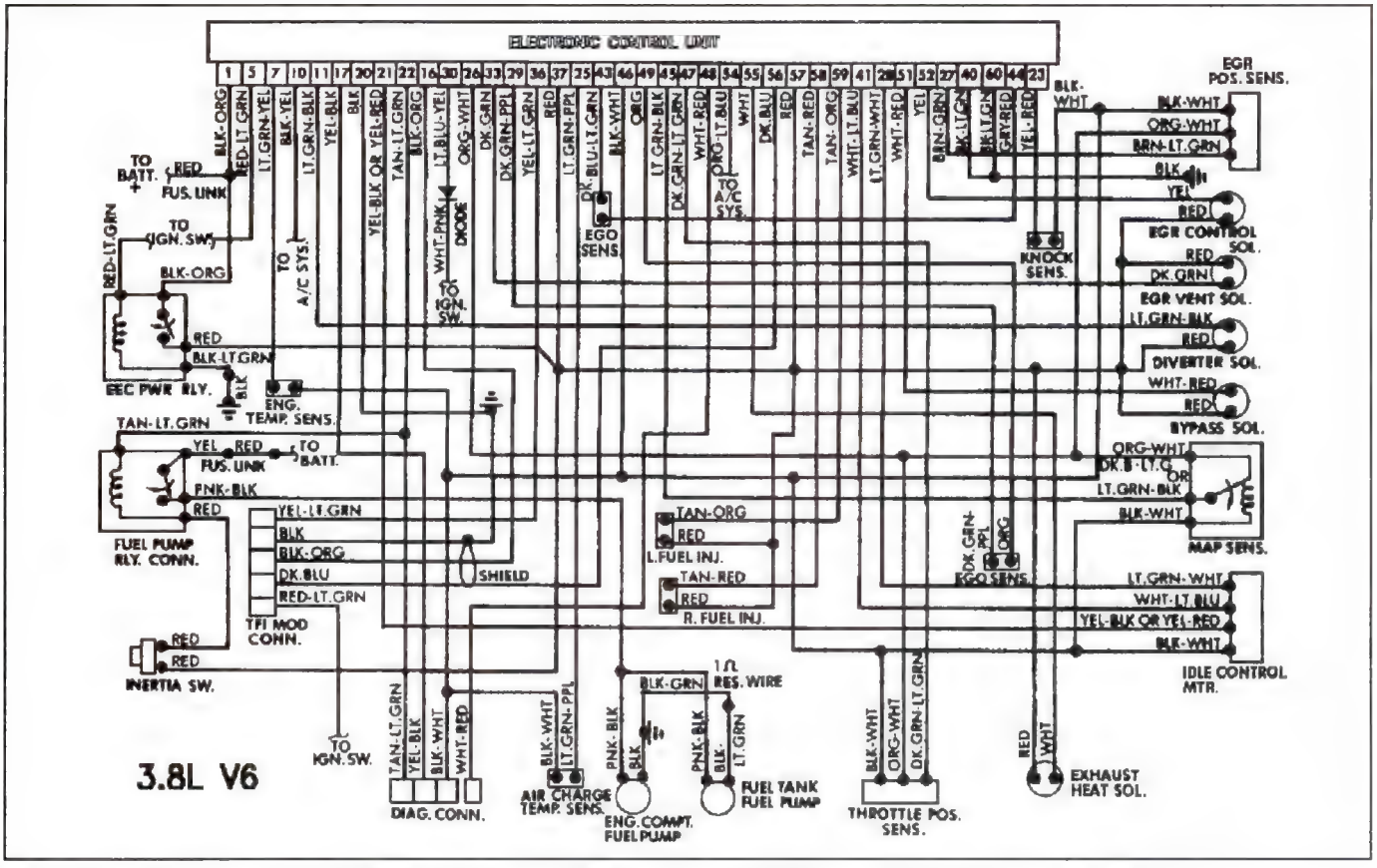


Fig.3: The schematic for Ford's EECIV in a typical CFI system, in a 1985 model LTD with a 3.8-litre V6.

KAM allows the ECU to remember engine fuelling needs, and it uses this information to calculate the fuel required for optimum combustion. This information allows calculations for the variation in drivers' habits, and compensates for engine ageing. It also stores idle information to maintain idle stability under all operating conditions. If battery power is lost for a prolonged period, all of this data is lost. Driveability problems may occur during the ECU's 're-learn' period (5 to 10km). Loss of KAM can also occur with sensor replacement.

Note that loss of KAM for the electronic transmission's ECU places the transmission in the Default Mode, and you'll know it. The Mode Indicator lamp will wink a 'code 99' at you. The ECU just lost its TPS (Throttle Position Sensor) data, and this must be established through the re-learn process which must be initiated by an autotech or the driver — if they know how.

(By the way, if the ECU temperature is 25°C, the power loss duration before KAM data is lost is 10 minutes. At 85°C, it falls to only 25 seconds — how fast are you at changing batteries or leads? Info on ECU re- learning is available in my *Code Book*, or the EECIV booklet.)

TABLE 1: Ford EECIV operating strategies...

1. BASIC ENGINE STRATEGY (BASENG). This contains the following modes of operation:

Crank	Under-speed	Closed Throttle
Part Throttle	Wide Open Throttle	Diagnostics
Open/Closed Loop	Turbo Boost	Run
High Speed Shutdown		

2. MODULATOR STRATEGY (MOS): This effects driveability
3. MPG LEAN CRUISE STRATEGY (MPGLS): This sets the AFR (air/fuel ratio) out of closed loop.
4. LIMITED OPERATIONAL STRATEGY (LOS): For 'limp mode' operation.
5. ADAPTIVE STRATEGY (ADS): Takes into account driver's habits and sensor wear.
6. FAILURE MODE EFFECTS MANAGEMENT (FMEM): Substitutes for failed sensor values.
7. NEUTRAL IDLE STRATEGY (NIS): Controls periods of extended idle.

Operating strategies

The vehicle will be operating in one or other of the strategies shown in Table 1, at all times. The strategies may have several modes, all selected in PROM, dependent upon operating conditions. Some vehicles may not have all strategies or modes.

Confused? Don't be, just remember the system is always in the BASENG strategy, unless it's in the LOS (Limp Mode). This will turn the CEL On. The FMEM strategy will also turn the CEL on, yet still be in BASENG's RUN mode. If the FMEM strategy cannot correctly substitute a value, the system goes into LOS. The diagnostic mode within BASENG is very important and requires further discussion.

Diagnostic mode

This allows the auto technician to retrieve fault codes and perform 'self-tests'. The best factory-trained auto techs *fix* Fords using this mode. Of course, they know what they're doing.

The self-tests require a set procedure to provide correct data. This is accom-

plished by hooking-up a hand-held tester (Fig.2) to the self-test connectors. Codes can also be retrieved via the CEL or even using a voltmeter — again, if you know what you're doing. After-market testers or 'scanners' are also available, which also work on other vehicles.

To test the car, you put the system in a particular test mode and the ECU does the rest. If it sees a failure, it sets a fault code. You now know which circuit or component has failed.

Learning about them

In my experience, not even factory manuals provide enough information on how a system works. They may tell how each component is supposed to work, then it's up to you to figure out the system operations.

Before electronic cars, auto techs were taught by symptoms. This required tedious testing procedures to find a fault. In lieu of testing, many techs simply changed parts 'until it worked'. The teaching system has not changed. However, swapping parts on an electronic system is very costly.

The fallacy is that many techs have never learned the systems — so they didn't ever know how it all worked. I know many of us in electronics use the 'black box' approach too, and manage to fix products without a schematic or system knowledge. But if we're honest we'll admit that we can fix things a lot *faster* with system knowledge.

Learning how the system works in a auto becomes difficult because we are not privy to the ECU's inner workings — its programs, software, firmware, etc. Even if we were, it might be of limited benefit — try teaching computer programming to an auto tech who's trying to make a living and raise a family.

My method gets around this by relying on an intimate knowledge of engine basics and how sensors/actuators work. Now all we need to know is: WHEN.

When? Yes, *when* everything is supposed to happen...

How do we learn this? Simply by applying logic and performing much testing under the bonnet. The EECIV system will help with its self-tests. To express this knowledge to other people, I explain it as understanding the 'Sequence of Events'.

I've heard many an instructor make this dumb statement: "The ECU does all this at the same time". I wish I had *that* CPU; it would be worth millions. Real-world ECU's have to do things in a sequence, responding to events and taking appropriate actions. To diagnose the system, we proceed through the sequence of events; if the sequence stops prematurely, we check the event for a cause.

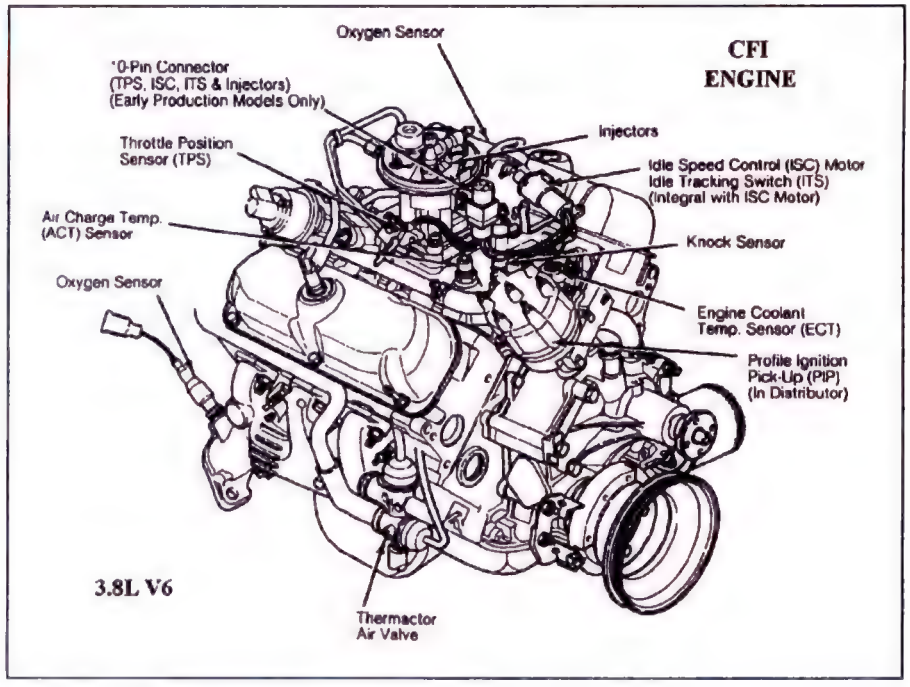


Fig.4: The V6 CFI engine, with some of the sensors and control valves identified.

Sequence of events

So let's get into it, because this is how it all works. Try following on the EECIV schematic shown in Fig.3. This is a CFI system. Aussie systems do not have an inertia (Crash) switch and only one EGO (Exhaust Gas Oxygen) sensor. I chose this because it's a small drawing and it's also the system on my wife's 1985 LTD 3.8-litre V6 (See engine Fig.4).

1. KOEO (KEY ON, ENGINE OFF). This is where the ignition switch is in the first position, and we're not yet cranking. Power is applied to the ECU, ignition ('TFI' stands for Thick Film Ignition) and fuel pump circuits.

At this stage the ECU reads all the sensors for data, the calibration tables (what car it is, etc.), the operating instructions, KAM data and the actuators for status. It then calculates the AFR, based on sensor data and lookup tables, and then turns on the CEL.

Note that it pays special attention to the CTS (Coolant Temperature Sensor). This sensor acts as an automatic choke on most fuel-injected cars. If cold, it will increase the fuel quantity. AFC (Air Flow Control) systems also monitor ambient (incoming) air temperature.)

The ECU knows the engine is not running (no Ref Pulse). The system is in the crank mode and waiting for cranking. If there's no cranking after three seconds, it removes the earth path from the fuel pump relay, turning the pump off. At this point, if the ECU has found a major fault, the CEL may start blinking (but not on all cars).

2. KOEO, CRANKING The ignition switch is now in the second (spring return) position, and the engine is being cranked. All lamps and accessories are switched off. The ECU has already sent control data to the Idle system. If cold, there will be a high initial idle. Right now it sees crankshaft rotation by receiving a Ref Pulse and opens the injectors, which spray fuel. The Crank Mode Engine Calibration, modified by temperature, determines the timing (fixed) and injector duration (on/off time ratio), until the ECU takes control of timing.

To facilitate timing, the distributor has a Hall effect pickup that outputs data to the TFI module. The TFI controls the coil and sends two signals to the ECU: the PIP (Profile Ignition Pick- up) and the coil firing pulse (negative coil lead — this is the Ref Pulse). After the ECU receives the PIP and the Ref Pulse, it sends back the SPOUT (Spark Output).

The timing is now ECU controlled. If the SPOUT is lost, the ignition system will run on PIP (i.e., fixed basic timing). If the PIP is lost, start pushing — the car will not start.

If everything is OK, though, the system is now in Run mode. (Note that every sensor effects timing.)

3. KOER (KEY ON, ENGINE RUNNING) The ECU is now off and running

again. It now checks the Diagnostic mode for faults, and if there's a hard fault (one that may damage equipment) it leaves the CEL on and places the system in the Limp Mode (LOS). If it finds a major sensor fault, it places the system in FMEM mode and blinks the CEL.

If there are no faults, it turns the CEL off. Note that the system stores intermittent (past) faults in KAM, for 25 engine cycles or until erased. However the CEL does not indicate whether or not a past fault is present; this can only be determined through Diagnostic Self-Test.

Immediately after the ECU establishes timing control, it sets Idle mode. The primary sensors effecting Idle are:

Coolant Temperature Sensor (CTS)
Air Condition (A/C)
Air Charge Temperature (ACT)
Neutral Park Switch (NPS)
Manifold Absolute Pressure(MAP)
Ref Pulse (Ignition)
Power Steering Pressure Switch (PSPS)
Electrical Load

Notice that the Ref Pulse effects idle, so that any sensor that effects timing also effects Idle. There are also other problems effecting Idle, which are not monitored by the ECU. Examples are fuel flow and excessive exhaust back pressure. We term these as non-electrical or mechanical causes.

You'd think timing and idle problems are common, and they are. Mostly they're caused by poor maintenance, misadjustments or mechanical failure.

Conclusion

This has been a brief description of how the Ford EECIV system works, and how to apply the 'sequence of events' strategy to diagnostics. But one article could not possibly cover it all, and there so many systems out there.

Here is how I learn the systems. I need the schematics, pin-outs and voltages, if available. I study the schematics to learn the system. I learn the sequence of events mostly by testing. It works for me, so take a look at the schematics and pin-outs and see what *you* can learn.

If you're interested in the EECIV systems, I have written a booklet on all Australian Fords (including F-Series trucks), that contains detailed information and fixes. It includes diagnosis, testing, codes, voltages, sensor and actuator operations, TPS re-learn and schematics. It is available for $60.00. The revised booklet *Maintaining the Electronic Motorcar* is still available, at $25.00, as also is the *Code Book* at $35.00. Send your orders to Major Al, PO Box 477, Double Bay, NSW 2028. ❖

Ham radio stuff?

Continued from page 52

glimpse of the packet radio scene. *Electronics Australia* published a complete 'Guide to Packet Radio' article in the November 1992 issue, followed by a construction article for the 'Pocket Packet' modem interface in January this year. Since then around 400 new amateur stations have gained access to the packet radio network by building the $79 Pocket Packet kit.

This little gadget connects to the mike and speaker sockets of an amateur FM radio, and plugs into the serial connector of an IBM-PC compatible computer, drawing its operating voltage from the computer. With the help of some clever software, included with the kit, you're up and running on packet radio.

The Pocket Packet kit is still available at the $79 price, pack and post included, from High-Tech Tasmania, 39 Pillinger Drive, Fern Tree, Tasmania 7054. *Electronics Australia*'s Reader Information Service can provide back copies or reprints of the articles for $7.50 apiece.

As for VHF and UHF radios, you can get information about Icom radios by writing to Reply Paid 1009, Icom Australia Pty Ltd, PO Box 1162, Windsor Victoria 3181. Kenwood's local head office is at 8 Figtree Drive, Australia Centre, Homebush, NSW 2140, while Yaesu equipment is stocked by Dick Smith Electronics, and can be seen at just about all of their stores.

In summary then, the new Novice Limited licence opens the doors of amateur radio to anyone who can pass a truly simple written test. The Morse code, formerly required for a Novice licence, has gone. This is not to say that Morse code is dead; you can learn the code and then move on to higher grades of amateur licences, culminating in the 'full' licence that lets you use HF radio to talk directly all over the world.

There has been a furious debate in amateur ranks over whether the code should be dropped. Many old timers say that they had to pass the code, and so should newcomers. But now that code is not compulsory, maybe some Novice Limited's will have a crack at learning it later on. It is jolly good fun to use Morse, particularly when you can use a flea-powered transmitter to work the other side of the world.

People say Morse code is a throwback to the past. But so are riding on steam trains and flying on DC-3's — true joys of the past that must never be allowed to perish.

See you on the bands? ❖

PC Interface for DSE's Teletext Decoder

Continued from page 69

Naturally you can experiment by changing this value. The next two lines read as follows:

```
%TELETXT SEARCH A1 100
%TELETXT SEARCH B1 120
```

You may have guessed that these two lines tell the Teletext decoder to search for page 100 and store it in display area A1, and then to search for page 120 and store it in display area B1. Since A1 is currently being displayed (displaying the Welcome! message) the moment page 100 is received this message will be overwritten by the new display. The delay subroutine is again called, allowing sufficient time to read the current page (page 100) while also waiting for page 120 to arrive. After this delay, the decoder is told to display area B1 (which will hopefully contain page 120). The line that does this is:

```
%TELETXT DISPLAY B1
```

The delay subroutine is once again called to allow sufficient time to read the page before our final message is written to the screen saying 'That's it!!!!'. The program line which does this is:

```
%TELETXT WRITE B1 20 12 &H5
```

Notice that we are telling the decoder to write this message to display area B1 this time, since that is the area currently being displayed. The message will be written on top of page 120 with most of that page still showing. The program is finally terminated by the statement &EXIT 0.

As already mentioned, the delay routine is rather complicated and uses the &TIME statement to read the PC's clock. Basically, if the delay routine is asked to provide a 59 second delay, it will read the current time then wait until 59 seconds have elapsed. Things are complicated by the time being in the form HH:MM:SS (hours, minutes, seconds), so suitable string manipulation and mathematics must be performed to find what the new time will be in 59 seconds.

The routine reads the clock in a continuous loop until the new time is found. At this point, normal program flow is resumed. Unless you really want to write your own delay routine, use the one described here and 'paste' it into your own programs. The subroutine begins with the label name -DELAY and ends with the &RETURN statement.

We are currently working on the development of more software for this project, so stay tuned. ❖

SHORTWAVE LISTENING

by Arthur Cushen, MBE

Sixty years of BBC broadcasting

Commencing with its famous Christmas broadcast in 1932 when King George V spoke to the world, broadcasts from London have moved from the Empire Service to the General Overseas Service and now to the World Service of the BBC in its life span of 60 years.

There may be some readers, along with the writer, who can remember that memorable broadcast on the morning of December 26 here in the South Pacific, when the first Christmas message was heard. The Empire Service was originally a link between London and the far flung colonies of the Empire and during the war, London maintained the role of the news provider and what the BBC said came to be recognised as a basis for excellent unbiased reporting.

Soon after the War it became apparent that to reach the world, relay bases had to be established nearer the target audience and this was one of the priorities. According to the BBC 1947 Year Book, there was already an established network of Forces Broadcasting Stations which were dependent to a large extent on the BBC to provide them with programme material. The first relay base of interest to listeners in the Pacific was established in Singapore and since then, a network of relay facilities has spread across the world.

Meanwhile, in Britain, the transmitters have been upgraded. Daventry, the first shortwave site has been closed and Skelton, Rampisham and Woofferton carry the bulk of the World Service from the UK.

There are relays on Ascension Island, Cyprus, Mairah Island, Hong Kong, Lesotho and Antigua, while the facilities of the Voice of America transmitters in North America are used on a reciprocal agreement and recently, transmitters in the former Soviet Union such as Radio Tashkent, are being used to reach Asia.

Improvement of reception

Between 1981 and 1991, the World Service received approval to spend some £125 million on improving the audibility of its programmes through a programme of transmitter building.

This ambitious plan was implemented in full, without cutbacks or retrenchments. On the capital side, new relay stations were built in Hong Kong, Seychelles, Rampisham and Lesotho. New transmitters were added at existing stations in Cyprus, Ascension Island and Singapore and older transmitters were phased out.

Bush House

The hub of BBC World Service in English, 24 hours a day, are the studios in Bush House in the Strand, London which houses all the facilities for shortwave broadcasting in 30 studios, in 36 languages as well as English, and reaching an estimated audience of 120 million people who listen at least once a week.

Big Ben is the familiar signal from the BBC in London and is still used particularly on the hour and quarter hour when it is heard on the World Service.

The newsroom in Bush House receives over one million words a day from the world outside. It is the newsroom's task to select the most important items, check the facts and prepare stories for the 200 or more news programmes transmitted around the clock.

At any time of the day or night there are news bulletins going out in one or another of the 36 different language services. At certain times there are as many as six languages being broadcast simultaneously. A central writing pool maintains a constant flow of stories in the newsroom which is manned by some 120 journalists working a 24-hour shift system.

The Centre Block which was opened in 1923, was designed by Irving T. Bush, and provided accommodation for manufacturers to show their wares to buyers worldwide.The BBC has occupied Bush House for over fifty years.

The Government has the final say about which languages are broadcast and the length of time each is on the air. Beyond this the BBC assumes full responsibility for all broadcasting operations and is completely independent in determining the content of programmes.

The BBC World Service operates 24 hours a day with parts of the transmissions directed to listeners in the Pacific.

For our morning reception the schedule is 1800 - 0030UTC on 11,955kHz and from 2000 - 2300 on 15,340kHz. Evening broadcasts are from 0600 - 0815 and are on 7150 and 9640, while the period 0600 - 0915 is on 11,955 and 17,830kHz.

At 1000, 11,750kHz joins 17,830kHz and at 1100 for 30 minutes, BBC Newsdesk is relayed by Radio New Zealand International on 9700 and the alternative frequency from Singapore is 9740. This frequency provides fairly good reception right through the night time listening in the South Pacific.

Australian signals for Somalia

Radio Australia recently commenced a special service for Australian Forces in Somalia and this is a daily transmission at

0400 - 0600 using the transmitter at Darwin on 17,840kHz.

From 0530 - 0630 there is a special programme originating from the Ministry of Defence in Canberra in which greetings from wives of Australian servicemen are broadcast, as well as some light music. The broadcast has been issued the callsign 2AAFR standing for Australian Armed Forces Radio.

The wives of Australian servicemen have a toll-free number to call and the greetings are then packaged together and broadcast in this special transmission daily. In order to make certain that the Australian servicemen hear the broadcast, it was announced on the second day of transmission that 100 shortwave receivers had been air freighted to Somalia so that the troops would have the facility to tune to Radio Australia.

Lowest powered broadcaster

Since its establishment in the late 1930's, the 10 watt broadcaster from Vancouver, Canada, has always created worldwide interest. It is regarded as being the lowest powered shortwave commercial station.

The writer first verified CKFX on 6080kHz which relayed mediumwave station CKWX on 1130kHz in 1940. The verification letter indicated that in 1940, the station had changed its location from the centre of town to outside the city limits. CKFX had also erected a new antenna system and was then using a 'V' type beam.

The original intention of the station in using shortwave was to cover the isolated areas of British Columbia to the north of Vancouver and over these past 50 years, the transmitter had been left running, relaying the programmes of CKWX which has a country and western format.

In 1986 I visited the studios of CKWX/CKFX and spoke to the chief engineer, Jack Wiebe, who when shown my 1940 verification of his station on shortwave, was somewhat amazed. He issued me with a verification of the then CKFX and mentioned that the possibility of keeping it on the air at the time was under discussion. The transmitter has been off the air recently and the reason was that after all these years it had come to the end of its useful life.

African radio problems

Most African countries are faced with severe budget cuts in broadcasting, and added to this there is now strong competition from Africa No.1 in Gabon. Its programme format of music and news has resulted in a large audience in West Africa.

Nigeria had an extensive network of shortwave stations, but due to economic reasons they have been shut down — only one transmitter was reopened in 1990 at Kaduna. Its broadcasts are 18 hours a day, including seven hours in English, four hours in French, four in Hausa, one in Arabic and three other one hour programmes in West African languages.

Most West African stations cannot compete with Africa No.1 at Gabon, and so the station in Nigeria concentrates on information, music and cultural programmes.

Another African station is suffering severe problems. The Voice of Ethiopia at Addis Ababa is using the former transmitter of ETLF, the Voice of the Gospel which was broadcasting until 1977, when it was nationalised by the Ethiopian Government. There has been no maintenance on the 100kW transmitter or the station buildings since that date, and there is water leaking into the transmitter building.

The Head of the Voice of Ethiopia told Jonathon Marks of Media Network that new equipment has been purchased abroad, but it is obvious that something will have to be done to rebuild the station.

ETLF was a popular station with shortwave listeners, being heard often in the Pacific. But the nationalisation of the transmitter, and the lack of any maintenance to the equipment, has meant a rundown in the performance of the Voice of Ethiopia. It is seldom heard on shortwave these days. ❖

AROUND THE WORLD

CUBA: Radio Habana Cuba broadcasts in English to Europe 2100 - 2200UTC on 15,165 and provides good reception in the South Pacific. A special programme of interest to shortwave listeners is DXers Unlimited, heard on Saturday at 2130. Radio Habana has also been noted on the new channel of 11,870kHz opening at 2100 in Creole and mixed with the Voice of America.

ECUADOR: Ecuador said some months ago, that due to the acute shortage of hydro power they would be moving to a new time zone four hours behind UTC. During their summer the position became much more satisfactory, there were some very heavy rain storms and on February 5, Ecuador returned to Standard Time which is five hours behind UTC. This did not affect the broadcasts of HCJB except for those which were carried on mediumwave and in the tropical bands for reception in the local area. These were retimed, while HCJB's major programme service is linked to UTC.

NEW ZEALAND: New Zealand returned to Standard Time on March 22 and after that date some frequency changes were made — in particular 17,770 was dropped from the schedule. Broadcasts are now 1650 - 1849 on 9675; 1849 - 0700 on 15,120; 0700 - 1207 on 9700kHz. Radio New Zealand International has recently released a comprehensive booklet on the transmitting facilities and its programmes, and this is available from RNZI, PO Box 2092, Wellington NZ.

OMAN: The Arabic Service from Oman uses several frequencies including 6085kHz for its Arabic transmission. At 2120 there is a period of Arabic chants and at 2130 a shortened version of the Oman National Anthem. Rex Gillett of Adelaide reports this signal is well received in his location.

SAIPAN: KHBI was recently off the air for transmitter maintenance as the transmitter was formerly that of KYOI established many years ago. The refurbishing has resulted in better reception and also the use of some new frequencies. For the period 1900 - 2055 they broadcast on 9355kHz and from 2100 - 2255 they are on 13,840kHz. Reports should be sent to the Christian Science Monitor, PO Box 860, Boston MA 02123, USA.

UNITED KINGDOM: BBC World Service Waveguide, a special programme for shortwave listeners, is now heard Wednesday 0415, Thursday 0130 and Saturday 1030UTC. The best reception in Australia would be the broadcast on Saturday on 9740, 11,750 and 17,830kHz.

URUGUAY: Radio Sodre Montevideo uses 9620kHz and is heard at 0900UTC and improved strength would indicate a new transmitter, reports Bryan Clark of Auckland NZ. At the same time, another signal from Uruguay, Radio El Espectador has been heard on 11,836kHz.

USA: KCBI Dallas is now carrying the University Network programmes and has been using three frequencies including 9815kHz heard at 0900UTC. The verification card indicates a list of other transmitters which are being used, including on mediumwave, Caribbean Beacon on Anguilla, and on shortwave High Adventure, Mt Hermon Israel; KVOH Simi Valley, California USA; Radio Moscow, Russia; and WWCR Nashville Tennessee USA. The address for all reports is PO Box 1, Los Angeles CA 90053, USA.

VATICAN: Vatican Radio has been heard on the new frequency of 7365 and programmes include Bulgarian at 1920, and at 2000 there is a service to Scandinavia. English to the South Pacific from Vatican Radio is daily 2245 - 2315 on 7310, 9600 and 11,830kHz.

This item was contributed by Arthur Cushen, 212 Earn St. Invercargill, New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Daylight Time and 12 hours behind NZ Daylight Time.

JAYCAR - YOUR No.1 DEALER FOR ALARMS SYSTEMS

GUARDALL GA105 WIRELESS BURGLAR ALARM SYSTEM

NEW FOR '93

New for 1993. Jaycar is proud to announce our brand new, low cost, quality wireless security system.

Features of the Guardall

• 4 sectors of which each will accept any number of PIR's, reed/magnet transmitters • Low battery display. You will be advised in two ways if a battery in a PIR detector or reed/magnet transmitter is low and needs replacing. The panel will display the battery condition and the transmitter will illuminate a yellow LED • 4 sector indicators on panel advise what state the alarm is in • If alarm is triggered LED will advise which sector has been triggered • Built-in 110dB siren, and external piezo sirens can be connected • PIR's are pulse count to avoid false alarms and are adjustable from 1 to 4 pulses • Adjustable alarm sounding time from 5 seconds to 180 seconds • Provision for back-up battery • Can be used as a door bell. If anyone enters protected area unit will give 'ding dong' sound • Remote control has a panic switch for instant alarm • Extra transmitters are not expensive (beware of this if considering competitors models) • Unit will auto reset after alarm sounds • Remote controls have slide covers that stops false triggering

The Guardall System Kit consists of:

1 x 4 sector alarm receiver panel • 1 x wireless pulse count PIR • 1 x reed switch/transmitter • 1 x remote controller • 1 x 240V plugpack

Extra PIR's, remotes and reed switch transmitters are available separately

What can be connected

• Back-up battery 1.2Ah (Cat. SB-2480 $26.50) • External piezo screamer • 12V siren/s - up to 1A max • NO and NC outputs for connecting strobe light, dialler etc., up to 5A max • As many wireless transmitters can be connected as you wish

Cat. LA-5220 **$399.50**

GUARDALL GA102A LOW COST WIRELESS BURGLAR ALARM SYSTEM

This 3 channel system is ideal for home units, small houses, etc.

Features:- • 3 sectors which each accept either a wireless PIR, wireless door/window switch • Two separate displays advise a low battery in a transmitter - a yellow LED in the PIR and a LED on the control panel will illuminate • 5 LEDs on control panel advise - power, on/off, low battery, zones 1, 2 & 3 • Built-in dual 110dB piezo sirens, and 12V external output for siren and/or strobe and N.C./N.O. dry contact output for security accessories • Adjustable alarm time from 5 seconds to 3 minutes • System will reset itself after alarm stops • 256 different programme codes • Provision for back-up battery - 280mA, 12V • Extra transmitters are not expensive • Remote controls have slide covers that stop false triggering • Panic function on remote control

The low cost Guardall System consists of:

1 x 3 sector alarm receiver panel • 1 x wireless pulse count PIR • 1 x remote controller • 1 x 240V plugpack. Extra PIR's, remotes and reed switch transmitters available separately. See optional extras above.

Cat. LA-5221 **$289.50**

NEW FOR '93

OPTIONAL EXTRAS

(Suitable For Both Guardall Systems)

• Remote Controls

These will (1) switch the alarm on and off (2) activate the panic button (3) put alarm into doorbell mode. Includes slide cover to stop any unintentional activation of buttons. Size 78(L) x 39(W) x 16(D)mm. Supplied with pocket clip and keyring.

Cat. LA-5222 **$44.95**

• Wireless Pulse Count Infra Red Detectors

These pick up any humans moving in the detection zone. As many of these can be used as you wish. For example you can connect 1, 2, 3 or more to one sector of the panel if you wish. They incorporate the latest PIR technology, including pulse count. This means the detector needs to be triggered 1, 2, 3 or 4 times in a 20 second period to trigger the alarm. This is settable by the 4 DIP switch in the PIR itself. 1 on for 1 pulse, 2 on for 2 pulse, etc.

Specifications

• Dual element pyroelectric sensor • 32 dual element zones in 3 layers • Wide angle 100° coverage • Pulse count switchable 1, 2, 3, or 4 • Low battery warning LED • Size 120(H) x 70(W) x 45(D)mm • LED indicator • Transmitting range 36 metres

Cat. LA-5224 **$99.50**

NEW FOR '93

• Magnetic Door/Window Reed Switch

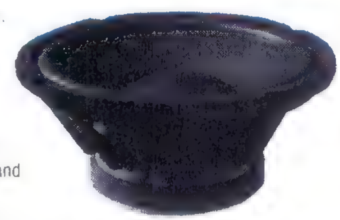
This device consists of a NC reed switch, magnet and a transmitter. The transmitter has been designed to be mounted close to the area being protected. As a door or window is opened a signal is sent ot the main alarm panel causing an alarm to be sound.

The one transmitter can be used to cover more than one window or door. For example, to cover one room, the transmitter can be mounted above the door, to protect it, and other NC reeds and magnets (Cat. LA-5070 $5.75) can then be wired in series to protect the window(s) of that room. This is explained in the comprehensive instruction manual that comes with the system.

Cat. LA-5226 **$54.95**

NEW FOR '93

CARBON FIBRE SUBWOOFERS - NOW IN STOCK



A range of three high performance, high quality carbon fibre cone subwoofers. These are especially designed for subwoofer applications with

• high output levels
• increased cone excursion limits
• high performance roll surround and suspension system
• high power handling capabilities
• large magnets
• carbon fibre cones - which are lightweight but strong, giving good transient response with accurate smooth performance and smooth frequency response
• designed to work correctly in relatively small enclosure sizes
• special designed solid frames to increase strength and rigidity of the suspension system
• Kapton insulation voice coils offer better reliability at higher voice coil temperatures, improving speaker life

For full specifications see page 36 of our 1993 catalogue

NEW FOR '93

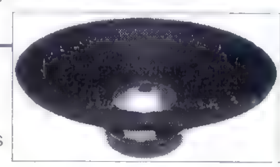
3 sizes available

6" Subwoofer Power handling 60W RMS Cat. CW-2162
ONLY $89.50

10" Subwoofer Power handling 120W RMS Cat. CW-2166
ONLY $129

12" Subwoofer Power handling 150W RMS Cat. CW-2168
ONLY $159

15" GUITAR SPEAKER SPECIAL

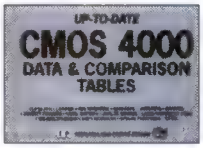


Massive 150W RMS power. For full specifications see 1993 catalogue.

Cat. CG-2382 **WAS $129 SPECIAL $109 SAVE $20**

5 NEW BOOKS FROM JAYCAR

No.1 UP-TO-DATE CMOS 4000 DATA AND COMPARISON TABLE - 1993 EDITION



It's finally out! The completely revised new edition of "CMOS 4000" including the logic families 40xx, 45xx, 47xx and 40xxx. This book contains over 300 useful pages of data incorporating basic explanatory data regarding the CMOS 4000 series and the list of manufacturers; characteristic data for different supply voltages, pin configurations and partial internal circuiting, as well as the static and dynamic logic behaviour of the circuit. It also presents the dimensional outline drawings of the IC and much more. This book is a must for designers and experimenters.

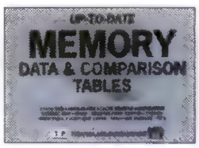
Cat. BM-4567 **ONLY $19.95**

No.2 UP-TO-DATE CMOS 7400 IC'S DATA AND COMPARISON TABLES

This book contains over 260 pages of essential information for the technician and the hobbyist. Includes: A list of manufacturers; combining all salient data such as abbreviations, data comparisons, pin assignments, logic tables and where necessary - notes, all on a single page. The "CMOS 7400's" tabulation should become an indispensible tool in your data collections.

Cat. BM-4566 **ONLY $19.95**

No.3 UP-TO-DATE MEMORY DATA AND COMPARISON TABLE - 1993 EDITION



This book is a great help in finding a suitable type device since it is itemised according to type, capacity and pin no. of the memory device, i.e. it provides the user with an overview of the many memory devices listed. All data important to the user such as memory organisation, case styles, technology, manufacturers, logic and programming tables as well as the connection diagram. Data includes dynamic RAM, static RAM, RAM modules, EPROMs, EEPROMs, these are just to name a few. This book contains over 400 pages and is very useful to anyone in the computer technical field.

Cat. BM-4565 **ONLY $19.95**

No.4 "THE PROGRAMMER'S TECHNICAL REFERENCE" MS-DOS, IBM PC AND COMPATIBLES

This book is unique in the history of the PC. It simply is impossible to find the information within these covers elsewhere, much is "undocumented" some is what the manufacturers would prefer you didn't know! The coverage of data is vast, and includes: the ROM BIOS; DOS interrupts and function calls; device drivers; enhanced and expanded memory specifications; conversion between MS-DOS and other operating systems; MicroSoft Windows application program interface; network interfacing; mouse programming; video sub systems. You would normally expect to pay well over $50 for all this information in one book.

Cat. BM-2482 **ONLY $24.95**

No.5 UP-TO-DATE WORLD'S TRANSISTORS - DIODES - THYRISTORS AND IC's COMPARISON TABLES A - Z

1993 EDITION VOL 1

Volume one lists comparison tables of nearly 28,000 types of components. Over 80,000 comparison and equivalent types given. Lists semiconductors with prefixes from A to Z. Softcover, 1095 pages 110 x 150 x 43(thick)mm

Cat. BM-4580 **ONLY $19.95**

Living on 12 volts with ample power

This book is a must for every user, builder or technician of alternate energy systems. This book explains how to store, produce and use alternate energy effectively

Subjects discussed include **How to produce energy** • battery chargers • alternators • generators • solar panels • wind/water generators **How to use energy** • 50% discharge rule • alternating days rule • DC to AC invertors • **How to store energy** • conventional batteries • sealed batteries **How to refrigerate** • continuous cycle DC refrigeration • engine driven compressors • intermittent cycle DC refrigeration

An invaluable reference for the energy systems you need to live without mains power

Softcover 344 pages 230 x 152mm. Cat. BC-1160 **$39.95**

Wiring 12 volts with ample power

This book explains how to wire 12 volt electrical systems. It covers **Know the loads** • lighting • pumps & motors • refrigeration • DC-AC inverters • furnaces • entertainment devices **Know the sources** • battery chargers • alternators • solar panels • wind/water generators **Know the batteries** • deep cycle • liquid electrolyte • sealed batteries **Know how to** • instrument the system • wire the circuits • troubleshoot • tools needed.

This book is chock full of wiring "How to" with schematics for many circuits. An ideal companion for "Living on 12 Volts"

Softcover 240 pages 230 x 152mm Cat. BC-1162 **$29.95**

HOT-SOL GAS SOLDERING IRON

Jaycar Electronics proudly announce a new force in Gas Soldering Irons

The Hot-Sol needs no cords or gas bottles. All you need is standard Butane cigarette lighter gas which is available everywhere and, of course, Jaycars' own Butane gas shown elsewhere on this page. The Hot-Sol has adjustable temperature control, you can vary it from the equivalent of 10 to 60 watts. This tool is so good, we have extended the warranty to one year.

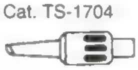
Features include:- • Totally see through case - see how much gas you have left at a glance • Supplied with protective cap with pocket clip • Built-in gas ignition • Fully portable, always ready to use • Heavy duty, tip temperature up to 400°C • Hard working, one fill will last an hour • Refills in seconds • No leakage current to sensitive circuits • Low cost • Spare tips available, and they are not expensive • Hot blow tip available • Supplied with 2.4mm tip.

Cat. TS-1700 **$38.95**

OPTIONAL EXTRAS

- 1mm soldering tip with catalyst Cat. TS-1704 $9.95
- 2.4mm soldering tip with catalyst Cat. TS-1705 $9.95
- Hot air tip for heatshrink Cat. TS-1708 $9.95
- Flame torch tip Cat. TS-1710 $3.95
- Small stand to suit soldering iron Cat. TS-1720 $3.95

Cat. TS-1704



NEW FOR '93

Cat. TS-1708

Cat. TS-1710

Cat. TS-1706

IDEAL FOR HOBBYIST OR TECHNICIAN

UNIVERSAL REPLACEMENT CELLULAR ANTENNA

Has your cellular antenna been lost, broken or stolen!! Well Jaycar now stock a universal replacement antenna for under $20. Replacement whip and base supplied

Frequency 800 - 926MHz • VSWR less than 1.6:1 • Gain 3dB • Impedance 50 Ω nominal • Power 50 watts continuous • Radiation pattern omni-directional

Cat. DC-4050 **ONLY $19.95**

NEW FOR '93

TURN YOUR SURPLUS STOCK INTO CASH!!

Jaycar will purchase your surplus stocks of components and equipment. We are continually on the lookout for sources of prime quality merchandise.

Call Mark Harris or Bruce Routley NOW on

(02) 743 5222

BUY 10 - LESS 10%

FULLY BUILT NiCad DISCHARGER

This discharger is a fully built and tested version of our popular KC-5120 kit. If you own a video camera, portable celluar phone, portable power drill, or any appliance that uses NiCad battery packs between 6 - 12V you will need to discharge your battery packs before charging. This effectively eliminates the "memory effect" that NiCads develop after just a few charges. If you're serious about extending the life of your battery packs (and let's face it, most battery packs cost well over then single outlay of this discharger), this unit is essential. The built version comes fully calibrated, and mounted inside a robust die-cast case, black powdercoated, with a silkscreened front panel and fly leads terminated with heavy duty alligator clips. Easy to operate, includes only one control, the battery voltage selector, complete with LED discharge complete indicators. A truly robust unit, portable, and built to last.

Cat. XB-4980 **$49.95** NEW FOR '93

GREENAIR NEGATIVE ION GENERATOR

PRICE BREAKTHROUGH

We have sold thousands of negative ion generators over the years. These work by building up a very high negative voltage, generating a stream of negative ion electrons which are emotted into the air. These ions then attach to particles in the air such as dust which are then attracted to the ground or other solid objects (just as metal things cling to a magnet), thus purifying the air.

Specifications • Dimensions 105(W) x 105(D) x 70(H)mm • weight 200g • range 14 sq mt (150 sq ft) • power consumption 240V model 3.8 watts, 12V model 2 watts.

When we first started selling negative ion generators they were $70

240V Mains Cat. YX-2910 **$29.95**

12V DC (with cigarette lighter plug) Cat. YX-2912 **$24.95**

TWO MODELS AVAILABLE

TELEPHONE TONE DIALLER BARGAIN

Generates DTMF signals

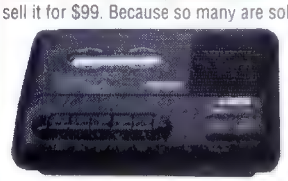
For use in conjunction with telephone answering machines, remote banking, computers, electronic voice mail and call diverters.

Was selling for $19.95. Now an amazing half price. This product is not Austel approved.

Cat. YT-6155 **ONLY $9.95** **SAVE $10**

BARGAIN PRICED ATD ANSWERING MACHINE

The ATD 1800 is a very popular answering machine. All the big stores and discounters sell it for $99. Because so many are sold, ATD get a quantity back from retailers which have been declared faulty. These are checked by ATD, and many are found to be O.K. The faulty ones are fixed. They can't be sold as new because they may have a scratch on them, or marks where the power lead has been wrapped around the unit.



All units are supplied with instruction manuals, phone lead and power plugpack. They have a 3 MONTH REPLACEMENT WARRANTY. Save 40% on the new price.

Cat. YT-7028 **$59.95** **YOU WON'T BUY CHEAPER?**

BARGAIN PRICED CORDLESS PHONE

The ATD MP250 Cordless Telephone is used daily by thousands of people in Australia. It must be the most common Cordless Phone. These units, like the answering machine above, were repaired if they needed to be, and can't be sold as new because they may have a mark on them. All units supplied with manual, leads and power plug pack. They have a 3 MONTH REPLACEMENT WARRANTY. These units sell new for between $99 and $129. Limited quantity available.

Cat. YT-7026 **ONLY $69.95**

SOLAR BATTERY CHARGER FOR 2 X C SIZE OR SUB C

This solar NiCad battery charger will charge 2 x C size, Sub C or AA batteries. Ideal for anywhere where 240 volts is not available. The solar panel is mounted in the lid, which is removeable from the charger. Also included is a circuit test button.

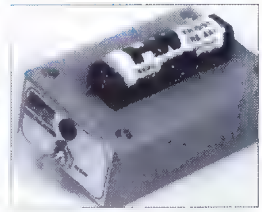
Size 119(L) x 65(W) x 39(H)mm

Cat. MB-3501 **$16.95** NEW FOR '93

NEW KITS

SINGLE CELL NiCAD DISCHARGER KIT

Ref: Silicon Chip May 1993



This discharger is unique in the sense that it requires no external power to operate, which makes it fully portable and extremely easy to use. Unlike our other popular discharger that suits packs from 6-12V (KC-5120), this unit has been designed to discharge AAA, AA, C or D cells. Housed in a tiny jiffy box, features include flashing LED discharge indicator, adjustable discharge current, 20µA cell current once discharged, reverse polarity protection, and a cut-off at 1.1V. The Jaycar kit comes complete with PCB, case, all components, plus front panel label. Cell holder not included.

Cat. KC-5132 **$27.95**

'WOOFER STOPPER' KIT

Ref: Silicon Chip May 1993

Do you suffer noise pollution of the canine variety? Sick and tired of trying to sleep or even watch TV with the neighbours dog barking with reckless abandon? At the press of a button, this handy device emits a retaliatory high-level supersonic tone that lasts for about 9 minutes. If the device is used on a regular basis, the dog eventually realises that it is going to be reprimanded if it barks, and eventually ceases the problem. We cannot guarantee that it will work with every dog. There are several reasons for this, first some dogs are just plain stupid. Second, many older dogs are deaf, although older dogs are generally not problem barkers. The Jaycar kit includes the piezo tweeter, case, panel lable, hardware, PCB and all specified components.

Cat. KC-5133 **$59.50**

FOR PEACE OF MIND

CURLY CORD TELEPHONE LEAD BARGAIN

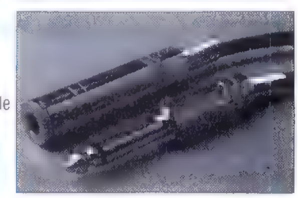
Another amazing surplus deal. These are the curly cords that connect between the telephone and the handset. Each has 4 core cable with a 4 pin RJ type plug on each end. They extend to 5.5 metres. Ideal not only for phones, but for low voltage cable, speaker leads, etc., etc. Grab some now while we have them. Great colours available. Were selling for $12.95 each in 1992.

White	Cat. YT-6030
Red	Cat. YT-6031
Blue	Cat. YT-6032
Black	Cat. YT-6033
Grey	Cat. YT-6034

ONLY $1 each **WERE $12.95**

GUITAR LEAD

6.5mm metal plug to 6.5mm metal plug. High quality, low loss black round shielded cable used. Length 6m.



Cat. WA-1050

$21.95 NEW FOR '93

Jaycar's exclusive range of new microphones are now in stock

PLASTIC SWIVEL BASE

NEW FOR '93

This plastic base is 10" (225mm) in diameter and swivels. It is ideal for computer monitors, stereo speakers, pot plants, lazy susans, etc Size 10" diameter. Height 17mm. Will handle up to 80kg

Cat. XB-2100 **$9.95**

LOW COST VERNIER CALIPERS

NEW FOR '93

6" (150mm) Internal/External/Depth

This plastic caliper is ideal when the use is only occasional and the expenditure of a stainless steel ($60 minimum) unit is not justified. They are calibrated in inch and metric with corresponding vernier scale. Claimed accuracy is 1/128in & 0.05mm, however we must say that comparison with our lab precision vernier reveals an accuracy more like 0.1mm at best. (The lab instrument 0.05mm genuine resolution cost 20 times more!). Excellent value for money.

Cat. TD-2080 **$4.95**

UPGRADE YOUR MIDRANGE

Quality white cone. Power handling 80W RMS system. Frequency response 350Hz - 5.5kHz. See catalogue for full specs. Cat. CM-2080

WAS $28.50 JUNE SPECIAL $20 SAVE $8.50

MAINS ISOLATION SAFETY BARGAIN

Lab technicians, designers, service personnel YOU MUST READ THIS.

Jaycar has secured a modest quantity of a 240 - 240V AC 1.5kVA mains isolation transformers. As you will be aware, isolating mains from the 240V return path can sometimes be a useful safety feature when designing or repairing mains equipment. It is also sometimes useful in high power audio applications. These units, part of a distress stock purchase by us, were designed and made in Australia for a large well known computer company. The cost of the components in them would amount to over $600 easily - not to mention the assembly. The massive isolation transformer is mounted in a custom 4-unit high rack case. The blank front panel is finished in black enamel. A massive 2.5mm thick sub panel carries the weight of the tranny. On the back panel is an IEC-320 style 240V inlet plug with a double pole circuit breaker, on/off switch, 4 x 240V IEC outlet sockets appear on the other end of the panel These sockets are wired in parallel with any of each or the 4 total giving 5.25 amps of earth free 240V. All 240V wiring is safely enclosed within the sturdy steel cabinet which is ventilated. Whilst the winding ratio is 1:1, i.e 240V to 240V there is no reason, **provided you knew what you were doing,** that you could not change the secondary winding (by reducing the turns) to, say, 115V. The transformers can be dismantled easily if you do not wish to do this there are plenty of people in the Yellow Pages who can do this for you. You could also, for example, reduce the secondary voltage (and increase the current) within the 1500VA parameters to produce a massive mains transformer for that 1kW + PA/Hi Fi amp!! The possibilites are really quite staggering An unmounted transformer of this size would normally cost around $600 in one-off quantities. But the factory's loss is your gain!! We are sacrificing these for the **FAR BELOW ORIGINAL COST PRICE** of $299 each. We would be amazed if this offer is ever, ever, ever repeated in anyones lifetime! Remember, if you work on mains equipment this product may save your life!

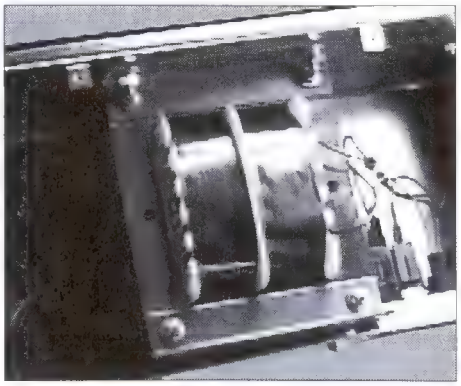
SPECIFICATIONS

Transformer:	240-240V @ 1500VA 5.25 amps continuous
Circuit Breakers:	10 amp trip
Front Panel:	485(W) x 176(H) (4 unit rack) x 218(D)mm
Weight:	22.5kg
Accessories:	Supplied with IEC-240V cord

Attention Mail Order customers: Due to the weight of this equipment, our mailorder dept. will have to quote you a price for delivery in your area.

Cat. XM-5150

ONLY $299



THE $2 POCKET TORCH

We have sold thousands of machined aircraft grade aluminium flashlights for $9.95. This torch is made of polished steel and gives out a very reasonable light. It's ideal for keeping in the glovebox, toolbox, handbag and around the house in case of emergencies. And at $2 you can certainly afford to Uses 2 AA batteries. Pkt 4 Cat. SB-2330 $1.60.

NEW FOR '93

Cat. ST-3010 **ONLY $2 each**

For Wholesale Ph: (02) 743 5222

TWO NEW DC POWER PLUGS

1 - 1mm hole - suits Sanyo Walkmans, Diskmans, etc.

Cat. PP-0504 **$1.00**

2 - 3.1mm hole - suits JVC Walkmans, Diskmans, Organs, etc.

Cat PP-0513 **$1.25**

STEPDOWN TRANSFORMERS AT AN AFFORDABLE PRICE

Manufactured in Australia from heavy guage steel, painted with white powder epoxy paint. Supplied with a carry handle, rubber feet, fuse and 3 pin output (115V) socket with earth.

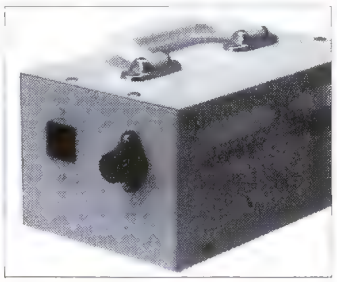
Built and designed to Australian standards AS3108. Approval No N11529. There are two sizes available

1. 240V -115V @ 250 watts Size 240(L) x 152(W) x 125(H)mm Cat. MF-1094

$179.50

2. 240V - 115V @ 65 watts Size 185(L) x 140(W) x 90(H)mm Cat. MF-1092

ONLY $99.50



BARGAIN UHF/VHF OUTDOOR ANTENNA

PRICE BREAKTHROUGH!!

A quality UHF/VHF antenna for under $40? That's right, due to jaycars' buying power we can now offer this ideal suburban antenna which is suitable for good to medium reception areas. receives UHF channels 28 to 36 (Band 4) and VHF channels 0-11. Sturdy construction designed for the do-it-yourself user.

Boom length 1.2m Cat. LT-3140 **$39.95**

NEW FOR '93

Jaycar ELECTRONICS

HEAD OFFICE
6 Leeds Street Rhodes 2138
Telephone (02) 743 5222
FAX (02) 743 2066

POST & PACKING

$10 - $24.99	$ 3.75
$25 - $49.99	$ 4.50
$50 - $99.99	$ 6.50
OVER $100	$ 8.00

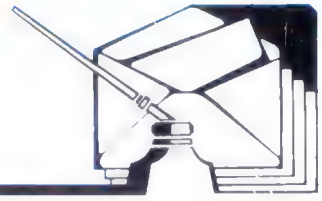
MAIL ORDERS
P.O. Box 185 Concord 2137
ROAD FREIGHT ANYWHERE IN AUSTRALIA (up to 20kg) $13.50

MAIL ORDER VIA
FREE CALL - FOR ORDERS ONLY
(008) 022 888
HOTLINE (02) 743 6144

Bankcard · MasterCard · AMERICAN EXPRESS Cards Welcome · VISA

ADELAIDE SA	190 Wright St (Cnr. Selby St) (08) 231 7355 Mon-Fri 9 - 5.30 Fri 8.30 - Sat 9 - 12pm
BURANDA QLD	144 Logan Rd (07) 393 0777 Mon-Fri 9 - 5.30 Thurs 8.30 - Sat 9 - 4pm
COBURG VIC	266 Sydney Rd (03) 384 1811 Mon-Fri 9 - 5.30 Fri 8.30 - Sat 9 - 4pm
MELBOURNE CITY	Shop 2, 45 A'Beckett St City (03) 663 2030 Mon-Fri 9 - 5.30 Fri 8.30 - Sat 9 - 2 Sun 10 - 4pm
SPRINGVALE VIC	887-889 Springvale Rd Mulgrave (03) 547 1022 Nr Cnr Dandenong Rd Mon-Fri 9 5 30 Fri 8 30 - Sat 9 - 2
SYDNEY - CITY	129 York St. (02) 267 1614 Mon-Fri 8.30 - 5.30 Thurs 8.30pm - Sat 9 - 4pm
BANKSTOWN	363 Hume Hwy Cnr Meredith St (02) 709 2822 Mon-Fri 9 - 5.30 Thurs 8 30pm - Sat 9 - 4 - Sun 10 - 4pm
GORE HILL	188 Pacific Hwy (Cnr Bellevue Ave) (02) 439 4799 Mon-Fri 9 - 5.30 Thurs 8.30 - Sat 9 - 4pm Sun 10 - 4pm
PARRAMATTA	355 Church St (Cnr. Victoria Rd) (02) 683 3377 Mon-Fri 9 - 5 30 Thurs 8 30pm Sat 9 - 4pm Sunday 10am - 4pm
PENRITH	199 High St (047) 21 8337 Mon-Fri 9-5.30 Thurs 8 30 - Sat 9-4pm Sun 10-4pm
RHODES	6 Leeds St (02) 743 5222 Mon-Fri 9 - 5.30

Information centre



Conducted by Peter Phillips

Exploding capacitors and RMS power

The letters this month cover all sorts of topics, ranging from brainwaves and RMS power to speeding. There are no major issues, although one contributor seems to be rather riled up about an idea presented in March. But first another problem...

I suppose all column compilers experience the problem of BAD HANDWRITING in contributor's letters. I hate to complain, as I want your letters, but oh boy! Some of the handwriting in letters I've received lately is jolly near impossible to read. Still, this problem is not unique to letter writing, as anyone in the service industry well knows.

Circuit diagrams and circuit descriptions are often incredibly difficult to interpret and to read. Skinny little circuit symbols with microscopic component numbering and values are quite common. In many cases, all you'll get will be a photocopy, as the original no longer exists. If the circuit spreads over two pages, you then have to figure out how the two circuits interconnect.

Manuals rarely help either, and if you get a circuit description, it will usually be very brief or impossible to understand. I was rather amused by the following description from a user manual for an uninterruptable power supply made in Thailand: *The unit has been designed to support a resistive load (light bulbs) of up to 250W for 3 minutes at 200 - 250W its sine wave output will start flatting.* I've copied it exactly, but despite the quaint terminology and weird sentence construction, I guess you get the point.

I'm always critical of clarity in user manuals and technical descriptions. When I upgraded my hifi system recently, I received manuals with each item of equipment. These range from grossly inadequate to barely useful. Notice that I praise none of them, even those from England and other English-speaking countries.

While the English is plain enough in most cases, it seems the editing has been carried out by someone with absolutely no knowledge of the product. This is the only reason I can think of as to why whole slabs of information are often missing from the manuals.

Anyway, let's move onto this month's letters, now that I've made a gentle reminder about legibility and had a whinge in general...

Time bomb

The first letter is from a reader who, to say the least, is not impressed with an idea presented in March. Aimed at giving a better pulse to car alarms that are triggered by a voltage drop, the idea is to connect an electrolytic capacitor in parallel with the interior light. The suggested value is 33uF (because that's what the contributor happened to have), fitted inside the interior light, because it comes on when a door is opened.

Seems a good idea? Not according to our correspondent...

I am very disappointed that nobody picked up, or at least commented on the letter regarding car alarms (not even Jim). Every technician worth his salt must have had a 100dB alarm bell ringing in his head after reading that letter!

Using a 33uF electrolytic capacitor rated at 16V in a car is almost criminal. Just think, the generator puts out about 18V when revved up.

Confined in a small space in the car, exposed to 150 degree heat (or even more), electros tend to explode with a vengeance. If you have never had one go up in your face, just try one — you'll never forget it.

Think twice about having a potential fire danger in the car. I would feel safer with a stick of dynamite in my car than with an electrolytic capacitor hidden somewhere. I wouldn't even trust one rated at 63V.

Think again, the fuses in the car are rated at 15, 20 and 25A — vapourising a little electro in a confined space near your head (interior light). As good as the idea seems to be, no thanks very much. (K.W., Hawthorn Vic).

You're probably writing from bitter experience K.W., but while I've had electrolytic capacitors explode, it's usually only when they're either connected the wrong way or when the applied voltage is way in excess of their rated voltage. After 30 years of servicing car radios (and owning them) I've never had an electrolytic explode inside one.

Personally, I think you might be overstating your case. The interior light in a car is only on when a door is opened, which doesn't usually occur when the engine is being revved, let alone when you're driving. And it's some electrolytic that can explode violently enough to send shrapnel through a cover.

However, I agree that a higher working voltage than 16V is probably in order. While I doubt death and destruction will occur with a 16V capacitor, especially a little 33uF type, a 25V rating is probably no more expensive.

'RMS power'

Sometimes we get so used to certain technical terms that we lose sight of the meaning. For instance, while I've always had a problem with AC voltage, I never (well almost never) tautologise by referring to my 'PIN number'. But when in comes to average, DC and RMS, I thought I had it all together. But maybe not, as the next letter discusses:

Why is the term 'RMS' commonly used in relation to power? For example, advertisements often describe speakers and amplifiers as being rated in terms of RMS power output. Shouldn't the correct term be average power in these cases?

The term RMS has a specific mathematical meaning and is commonly applied to the measurement of AC voltage and current. As I understand the mathematics, for a resistive load: (average) power = Vrms x Irms.

The emphasis here is on average as applied to power. An RMS value for power could be calculated, but it would generally not be the same as, and would have a different mathematical meaning from the average power. (H.N., Gulgong, NSW).

Good point, H.N. Most text books refer to power in an AC circuit as average power, which for a resistive circuit is the equation you give: Vrms x Irms. In a resistive circuit the average power is always positive, because the current and voltage are in phase.

In a reactive circuit, there is a negative power component (power returned to the source), and the average power can therefore be zero if there's no resistance.

So where does the term RMS power come from? Is there such a thing? Certainly the term is used freely by manufacturers of audio equipment. Here RMS power is taken to be the power that can be continuously delivered to a resistive load compared to instantaneous power (formerly often called 'music power'), which is the maximum power the system can deliver to a load for a specified period.

From my brief research into this, I can't find any reference to RMS power. Perhaps a bit of maths might help here, so imagine you have a sinusoidal voltage with a maximum value of 2V across a 2 ohm resistor. The RMS value of the voltage is 2V x 0.707 = 1.414V. The RMS current in the resistor will be 1.414/2 = 0.707A. If instantaneous values of the current and the voltage are found, multiplying them gives an instantaneous value for power. Summing these values and dividing by the number of values gives the average power value. This will be 1W, which is also the product of Irms and Vrms.

By definition, an RMS (root mean square) value is the square root of the average of the sum of the squares. For the example I'm using, you get 1.5W.

So quite clearly, an average power value doesn't equal an RMS power value. This also applies to an alternating sinusoidal current or voltage, where the DC value is also its average value, which is usually zero.

Therefore, it seems to me that the term RMS power is a loosely used term to imply average power. By saying RMS, it infers the power derived by using an RMS current or voltage value. Any thoughts from readers would be welcomed.

Radio frequencies

At first I wondered if I'd be able to help the writers of the following letters. I'm not involved in shortwave radio listening, ham radio, scanners and the like, so I couldn't conceive there would be a book listing all the frequencies you can listen to. I'm therefore surprised that there's *several* books, all of which must have taken a lot of compiling. The first letter asks...

I have got myself a scanner and I am wondering if you can buy books on frequencies. I pick up some frequencies but I particularly want a book to give me more information. (G.T., Kariong NSW).

A suitable book is *Dick Smith's Australian Frequency Handbook*. This book is advertised as 'an essential book for anyone into scanning' so G.T., it should be what you are after. Obviously it's available from Dick Smith Electronics, and is listed in their 92 - 93 catalog (page 194) for $24.95. Of course there may be others from other suppliers that I haven't caught up with.

The writer of the next letter is into shortwave listening...

I recently acquired a small shortwave receiver and have much enjoyment listening into foreign broadcasts. I have read with great interest articles published in EA regarding shortwave bands. However, I am writing to ask if there is a publication or organisation that can summarise all the available bands that can be received in Australia.

I understand there was a shortwave listeners club based in Melbourne at one time, but am unsure if it still exists. If you know of any clubs or suitable publications I would be interested in the titles or contact addresses. (A.C., Burnie Tas).

As it turns out, there are quite a few books that list shortwave radio frequencies. One of these is Ferrell's *Confidential Frequency List, reviewed by Jim Rowe in the March 93 issue of EA* (page 50). This book covers frequencies from 1613kHz up to 28MHz and includes RTTY, CW and fax used by all sorts of organisations. It's available (for $32) from Arthur Cushen, 212 Earn Street, Invercargill NZ and also from Technical Books, 299 Swanston Street, Melbourne.

Two others that give similar information are *Passport to World Radio* ($34.95) and *World Radio TV Handbook* ($35.95). These are both available from Dick Smith Electronics and the prices I'm giving are from their 92 - 93 catalog.

Another that was sent to us for review a while back is the *Frequency Spectrum Reference*, Volumes One and Two. These cover from DC (does anyone transmit on DC?) to 29.999kHz, and are available from the publisher Rodney Letts, of 446 Boronia Road, Wantirna South 3152.

By the way if there are any SW listener clubs, please let me know and I'll include the details in this column.

Speed monitor

The topic of speeding has been mentioned before in this column during a discussion on radar detector detectors. While that topic has run its course, I recently met someone who was actually caught by the police and charged with having a radar detector. He was picked up by an unmarked police car, fitted with a radar detector detector. The fine was $880 and the radar detector was confiscated. Needless to say, he no longer uses a radar detector!

The next letter has caused me a bit of trouble to decipher (due to the handwriting) but is a plea for help. If I have incorrectly addressed my reply, perhaps the writer will recognise what it's all about. Here's what I think the letter says (with my usual editing and abbreviating):

I am seeking your assistance. I would like to build a speed monitoring indicator with sound as my wife has been in trouble for exceeding the speed limit. If I could install a unit that sounds when she reaches certain preset speeds, it would help her remain within the limit.

I would be very grateful if you could let me have a circuit or details of where I could purchase a kit of such a device. I have a 1981 VC Commodore. I understand that the new Calais models have this facility built in. (F.M., Torrensville SA).

There are two projects that come to mind. The first is a Digital Speedo presented in the January 1991 issue. This unit has a switch to select preset speeds, and when these are exceeded it sounds a buzzer.

The project was originally sold as a kit by CTOAN Electronics, who have now moved to Queensland. At this stage, I don't have a new address, so you'll need to buy the components from an electronics parts supplier. Fortunately, the parts are all pretty standard, and the printed circuit design was included in the article.

The second is an Over-speed Monitor presented in December 1989. This unit has a LED indicator and a buzzer that lets you know when you're exceeding the limit. Kits for this project were originally sold by Oatley Electronics, who may still be able to offer some support for the project.

INFORMATION CENTRE

Bio-feedback

While the next letter is easy to read (although still handwritten), I'm not sure I can really help...

Having been an avid reader of EA for many years, I have never sent you a letter requiring information. However, I now have a problem that you or your readers may be able to help me with.

Over the last few months I have developed an interest in bio- feedback. I am most interested in the measurement of brainwaves (alpha, beta, theta, delta) and the machines that measure them. I bought a magazine (I'm not sure if it was EA) some years ago about bio-feedback projects. It has projects on heartrate monitors, galvanic skin response and several others, but nothing on measuring brainwaves. I need an amplifier that will boost the signals and a method of graphically displaying them. I hope you can help me. (Bruce Kilgoor, Box 622 Mossman, F.N.Q 4873).

The articles referred to by Bruce were published in *ETI*, and didn't include anything on brainwaves. I have to admit to being rather ignorant on this phenomenon, and I wonder how you sense a brainwave. Does one insert a sensor (or two) somewhere, or can a surface sensor on the skin do the job?

(Editor's Note: Come on, Peter — this isn't the April issue! Even I know it's done using an array of electrodes attached to the scalp...)

However, I would think that if a brainwave is simply a small electric voltage, the amplifier and display system would simply consist of a suitably sensitive preamp, coupled to a calibrated oscilloscope. Anyway, I did say I don't know and if any readers can help Bruce, perhaps you might contact him. I'd like to know the answers too!

Yellow LEDs

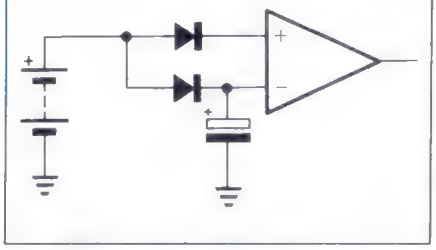
Here's an interesting question...

Perhaps you can help me with a problem I have. I own a model railway and have been changing my signal lights over to LEDs.

The trouble is the 3mm yellow LEDs from Dick Smith Electronics and other electronic component dealers I have tried look a different shade of green instead of yellow. The orange ones are just as bad. They look a different shade of red. Where can I get 3mm LEDs that do look yellow? I have seen them in equipment at work.

In fact, I've seen them in Queensland Rail's signalling boards in signal cabins.

Fig.1



One cannot mistake them for green. They are definitely yellow.

The signals are run from an AC supply using a resistor to limit the current. The LEDs use half the supply cycle and have a small diode across the anode to cathode to conduct the other half cycle. The signal lever frame is an old Tri-ang type using 15V AC to operate the signals. The 3mm diodes are needed to fit the Tri-ang electric signals. (W.H., Gladstone Qld).

While I agree with you W.H., I don't know the answer. My stock of LEDs comes from all over the place and while some are more yellow than others, I really have no idea where I got them.

Perhaps the colour quality of LEDs is proportional to price, and those from typical parts suppliers may be the budget types. If I'm right, two suppliers you could try are RS Components and Farnell Electronic Components. Both companies carry a large stock of parts and, while sometimes more expensive than DSE and others, most of the components they sell are made in England or Europe.

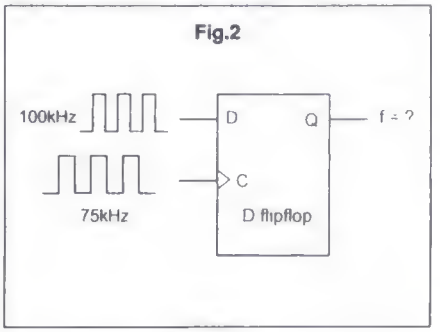
Therefore perhaps *their* yellow LEDs are really yellow, if more expensive. The Sydney phone number for RS Components is (02) 669 3666 and for Farnell it's (02) 645 8888.

TV signal repeater

Here's another one of those 'can a reader help' enquiries:

I have been a keen reader of EA for many years, most particularly your Serviceman and kit projects columns. I would be very grateful for your help in identifying products on the market which can be used as a mini-repeater TV station, similar to the VCR video-sender units currently available.

Fig.2



We live in a poor TV reception area (150km from the city transmitter) which requires a large aerial, masthead amplifier and cable connection to each TV set. I would like to dispense with the cable distribution in favour of a small broadband repeater station. Is there such a product available locally? If not, would your backroom boys be able to come up with one for us kit builders? (R.K. Wallaroo SA).

This is an interesting question, R.K. I haven't seen such a device other than the low power types used to send an RF signal to a VCR. In fact, I wonder if one of these might suit your purposes. I assume you are trying to eliminate cable losses and set up a more flexible distribution system. I'm sure you realise that the signal quality won't be improved (possibly even degraded), although you'll certainly get a very flexible system.

I can think of two reasons why such a product may not be available, and these are the same reasons why we haven't designed such a repeater. In the first place, as anyone who has a video-sender will attest, it's difficult to prevent interference with other users. I know of several instances where quiet living folk have suddenly seen a 'blue' movie flash on their TV screen, by courtesy of the house next door.

Another reason is quality. It's not easy to get rid of noise and distortion in such a device, and the quality of the picture from many video-senders is quite poor. Still, there may be a suitable product, so if someone can help, please write to me and I'll let our correspondent know.

Mains interference

The next topic concerns interference that appears to be coming from the mains. It's from a student whose grasp of the English language makes it rather difficult for me to be sure what the problem is. Here's his letter, edited as best as I could...

I moved to a new flat a few weeks ago and I find that my TV, VCR and hifi system are being affected by a periodic noise. I have asked my university lecturer (I am an electrical engineering student) and he told me that the sound is from the unstable power supply. Therefore, I bought a surge and noise guard made by Kambrook (cost $40), but there's no improvement.

I have tried to find other filters, but those available are rather expensive. For instance, one from Dick Smith Electronics costs $89, another from Fred Davis is over $150. Can you recommend any other

products, or is it possible I could make one? Are there any reference books about making power noise filter circuitry, or has EA already published such designs. (L.Y., Kingsford NSW).

Your reference to 'unstable power supply' at first made me think you might have a computer power supply somewhere close by. These can cause considerable interference to TV reception, and might even be audible in an audio system. But on reading further, I think you are referring to interference from the mains.

Unfortunately, you don't give enough information. For instance, does the noise occur late at night, at roughly the same time? If so, I suspect the noise is being caused by the tones used to switch off-peak systems.

And what type of noise are you getting? If it's white noise, then I'd suspect a faulty insulator on the overhead wiring, or even a bad connection in the mains. Perhaps you are getting clicks and pops, which are always difficult to get rid of. The problem here is best solved by putting a suppression capacitor (mains rated) across the offending appliance or switch.

Maybe the noise is not from the mains. Perhaps someone has a video-sender in the next flat! A CB set can also cause havoc to TV reception (and telephones sometimes). There are many possibilities and I'm not sure where to start.

If you think a mains filter will help, *EA* has certainly described a line filter and conditioner, in the July 1988 issue on page 80. There have been others, but this one doesn't rely on special parts.

If the problem is from the overhead wiring, you should contact the local supply authority. You can verify this as the source of the problem by asking other residents if they are having the same problems. Otherwise, you'll have to give us more details if we are going to help any further.

Fast charger

These days, most NiCad battery chargers do the job in an hour or less. But how does the charger circuit know when the battery is charged? I'll explain after our next letter...

I am writing to obtain information about a 7.2V peak detection circuit for 7.2V batteries. The circuit needs to be a fast charger with the peak detector detecting when the cells have taken a full charge, so it can then revert to a trickle charge. Any information will be of great help, as it is going to be incorporated in my major project for my HSC this year. (B.C., Campbelltown NSW).

I'm assuming you mean a NiCad battery charger B.C., based on your figure of 7.2V which is the voltage of six NiCads in series. The circuit of Fig.1 is probably what you're after, but first a word of explanation.

When a NiCad battery is being charged, its terminal voltage will rise as the charge is in progress. When the battery reaches full charge, the terminal voltage will start to drop. The figure I have is -7mV/cell/°C. This value isn't as important as the fact that the terminal voltage drops at full charge.

Most commercial chargers, such as those built into computers, video cameras and other battery operated equipment, use this principle. A peak detector like that in Fig.1 is used to detect the falling terminal voltage. In this circuit, while the battery voltage rises, both terminals of the op amp will have the same voltage, and the output of the comparator will be positive (perhaps arranged with a small external bias).

When the battery falls, the capacitor remains charged holding the (-) input at the previous voltage. However, the voltage at the (+) input will now be less, and the comparator output will be negative (or zero). This can then be used to switch the charger to trickle mode.

This circuit only shows the principle B.C., but you should be able to do something with it. Good luck in your HSC.

What??

A digital question this month, and quite an interesting one I think you'll find. It comes from Ron Steinfeld, (Glen Waverley Vic), as a result of work he was doing on a circuit design. Here's the problem.

What is the frequency at the Q output of a D-type flipflop if the clock frequency is 100kHz and the frequency of the signal applied to the D input is 75kHz? The circuit of Fig.2 summarises the situation.

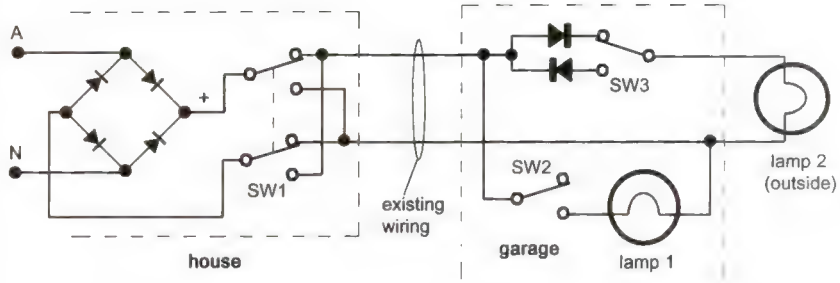
Answer to May's What??

The circuit is shown in Fig.3. The clue lies in the use of an intermediate switch (SW1) and a few diodes. An intermediate switch is often used in lighting circuits to expand a two-way circuit to an 'n' way circuit, where one light is controlled by n switches. The Clipsal type (catalog number 30MI) costs around $18.

The incoming mains is rectified, then fed to the garage via the intermediate switch. The supply to the garage is a full wave DC with a polarity determined by the position of SW1. Lamp 2 is controlled by SW1 and SW3 (which form the two-way circuit).

For the switch positions as shown, lamp 2 will be on. Operating either SW1 or 3 will turn the lamp off. Lamp 1 (the original garage lamp) is operated with SW2. The only limitation is that you can't use fluorescent lamps. ❖

Fig.3

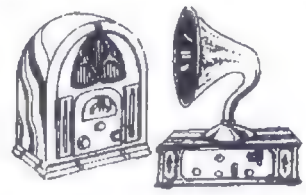


NOTES AND ERRATA

50MHz Frequency Counter, February 1993: The following erratum has been sent by reader Graham Leadbeater.
U10a: (a NAND gate) should be shown as an OR gate with inverting bubbles at the input, not an AND gate with inverting bubbles.
U6, U9 and U10: Vcc should be pin 14, not 15.
U10c: not shown, is an unused gate, inputs 12 and 13, output pin 11.
U8d: output pin not numbered, should be pin 3.
U7a: pin 10 not labelled, is S-bar, pin 13 (R-bar) is not shown.
U7b: S-bar and R-bar (pins 4 and 1) are shown on U7a, should be on U7b.
U3, 4 and 5: The outputs linked back to the C1 inputs are Q0, not Q1 as labelled. The pin numbers are correct. The Vcc pins (not numbered) are pin 16, and the ground pins (not shown) are pin 8.
68705 Development System, March 1993: The parts list should show Z1 as a 22V device and Z2 as a 12V device, not the other way round as printed. The circuit diagram is correct. ❖

Vintage Radio

by PETER LANKSHEAR



IF amplifiers and their transformers

Superheterodynes have such important advantages over simpler types of receiver that for the past half century, their use has been practically universal. This month we look at intermediate frequency or 'IF' amplifiers, the key to the successful performance of any superhet.

The 'supersonic heterodyne' receiver, to give it its full name, had its origins in World War 1. There is evidence to show that the French pioneered the superheterodyne concept, but Major Edwin Armstrong of the American Army Signal Corps is generally credited with creating the first working examples, and his work for General Electric enabled RCA to market the first domestic models.

Initially, the problem that led to the invention of the superhet was that of obtaining any useful amplification at frequencies around 1MHz and higher with the triode valves that were then available. The solution embodied in the superhet was to use the principle of 'beating', whereby the received signal was combined with a continuous locally-generated signal, to create a third lower frequency beat or *heterodyne*. (Musicians have, of course, for centuries known about the production of a third note from two others by aural beating.)

This new signal of much lower frequency (although still above the audio range — i.e., *supersonic*) could then be amplified and detected by conventional methods, and Armstrong originally used a resistance-coupled amplifier. Known as the *intermediate frequency* amplifier, and soon shortened to 'the IF', this section of a receiver has a major influence on receiver performance.

Initially, the purpose of the IF amplifier was simply to provide gain, and resistance-capacity or untuned transformer coupling was adequate. But by the late 1920's it was realised that tuned circuits would confer considerable advantages in terms of higher gain and controlled selectivity.

Depending on their size and complexity, domestic valve receivers had one and sometimes two stages of IF amplification, coupled by coupled tuned circuits known universally as 'IF transformers'. With rare exceptions, these were contained in individual shield cans, with a remarkable range of styles, shapes and sizes — round, square and rectangular, with the older types usually having the largest cans (Fig.1).

A major advance in size reduction and efficiency was made in the late 1930's, with the introduction of powdered iron cores for the windings. More recently, ferrite cores have become universal.

Bandpass tuning

Although variations will be found, general practice was to use two tuned circuits for each transformer. A pair of tuned circuits in close proximity and resonant at the same frequency display some very special characteristics. With the windings well spaced, only signals in a narrow range of frequencies will be passed between windings and severe sideband reduction occurs, limiting audio bandwidth in receivers using normal intermediate frequencies. The bandwidth and signal transfer increases as the windings are brought closer together, until at the spacing called the 'critical coupling' point, the response curve is more broadly peaked, and energy transfer is at a maximum.

Critical coupling is frequently used in IF transformers, as it gives a good compromise between selectivity and reason-

Fig.1: Valve IF transformers came in many shapes and sizes, and many manufacturers had their own distinctive patterns. In this group from the author's junk box, there are cans made from aluminium, copper and zinc.

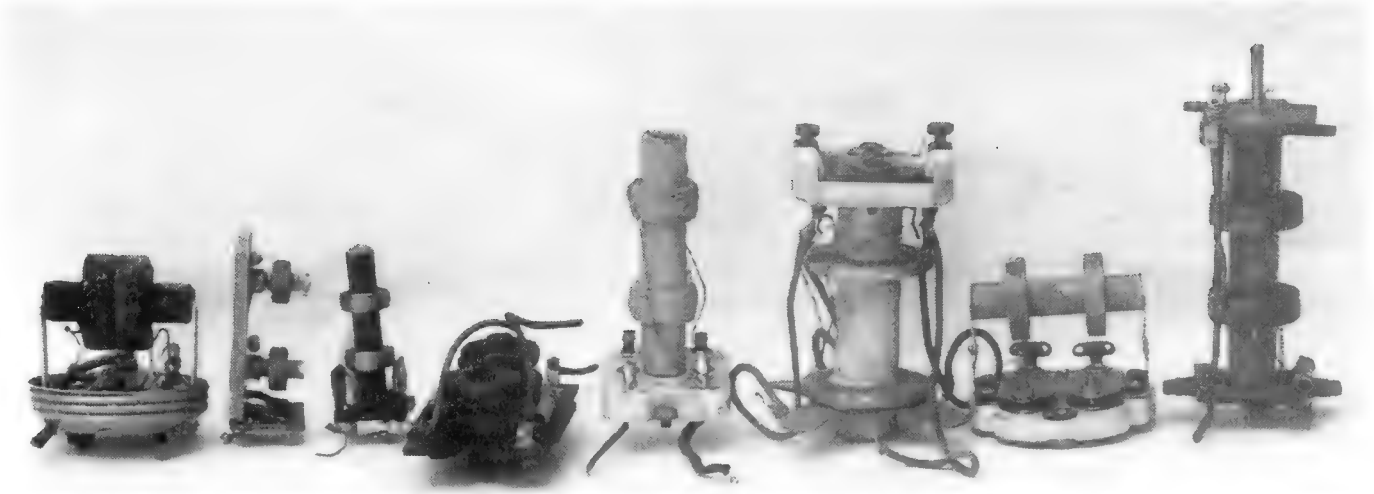


Fig.3: IF transformer contents varied as much as their cans. The example at far left has a single tuned winding closely coupled to an untuned secondary; the rest all have two separate tuned windings, with either trimmers or slugs.

able quality. If however, coupling is further increased, an unusual situation occurs. A peak appears symmetrically either side of the centre frequency and as coupling is further increased these peaks shift further apart (Fig.2). This characteristic is used to good effect in broadening the IF response in 'high fidelity' or wideband receivers.

No standard IF

There is really no standard frequency for IF amplifiers. The first untuned transformers favoured frequencies of around 50kHz, but by 1930, 175kHz tuned IF transformers had become popular and were used to a certain extent throughout the decade. This frequency provided stable high gain and plenty of selectivity, and may well have become the industry standard frequency. But within a couple of years, shortwave listening had become popular, and for multiband receivers, 175kHz was found to be too low for receiver RF circuits to separate fundamental signals from their heterodyning images or 'second spots'. Consequently shortwave stations appeared on two places on the dial.

To minimise this problem, intermediate frequencies were raised, generally to the region of 450 - 475kHz, as high as was possible without encroaching on the broadcast band. These frequencies are still used.

'All wave' European and English receivers had a problem, because of Europe's longwave broadcasting band on 150 - 300kHz. To simplify tracking, many had an IF of only 110 - 125kHz and there was a serious image problem in these radios. Even standard broadcast band images are a potential problem with IF systems operating below about 250kHz, and in these cases two RF tuned circuits will frequently be found ahead of the frequency converter. It is therefore usual for a receiver with 175kHz IF amplification to have a three-gang tuning capacitor, regardless of whether or not there is an RF amplifier stage.

Despite some efforts at standardisation, there was no consistency in the choice of intermediate frequency. A quick check through the *Australian Official Radio Service Manual for 1938* shows no less than 15 different frequencies, ranging from 175kHz to 470kHz, in use for that year's models! Most were in the range 446 to 470kHz, with Stromberg-Carlson using the very odd frequency of 392kHz.

As can be seen in Fig.3, many methods of IF transformer construction have been used, but windings were invariably in separate 'pies' with higher frequency transformers wound with stranded wire. High frequency currents do not travel uniformly through conductors, but are concentrated on the surface by 'skin effect', which reduces the efficiency of coils. This effect is minimised by the use of *Litzendraht* wire, known universally as 'Litz' wire.

Litz wire is a braided cable made up of strands of fine wire woven so that each strand passes from the centre to the outside at regular intervals. This forces each strand to carry its share of the current and so lowers the RF resistance of the coil.

Early IF transformer windings were usually mounted on a wooden dowel and attached to a block of insulating material containing adjustable trimmer capacitors of the mica dielectric variety. Later the dowel was mounted vertically to permit a reduction in the diameter of the shield can. Domestic receiver transformers using variable capacitance tuning invariably used mica dielectric trimmer capacitors, usually mounted in a ceramic or

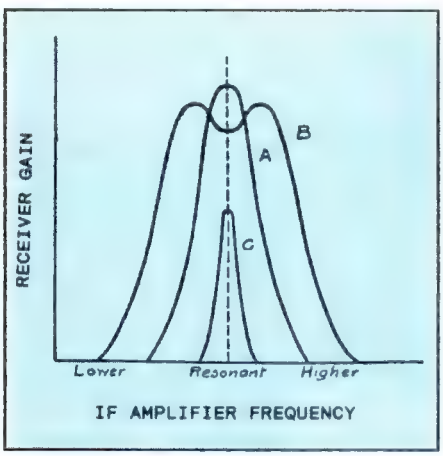


Fig.2: The effect of coil spacing on the frequencies transferred by coupled tuned circuits, as in an IF transformer. A is optimum or critical coupling, C shows under- and B over-coupling.

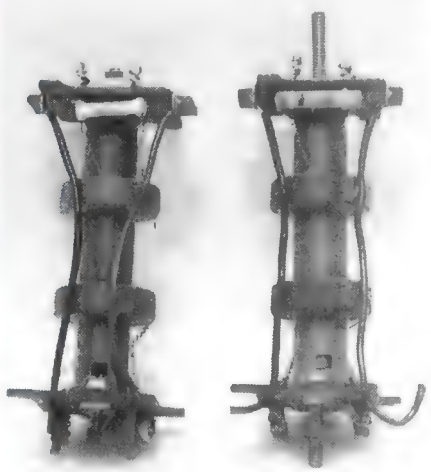


Fig.4: Both are tuned to the same frequency, but the IFT on the left's cores are in the incorrect 'inner' position.

bakelite block. Fixed capacitors were frequently used to provide additional capacitance.

In the mid 1930's iron dust slug cores were introduced, to raise efficiency by reducing the amount of wire needed. Later the position of the iron cores was made adjustable for tuning, rather than using trimmers. These variable-inductance tuned transformer windings always have a fixed capacitor, generally mica or ceramic dielectric, with polystyrene found in some modern transformers.

Another development was to turn the coils through 90°, so that they were alongside each other, rather than axially on a common former. Later still, windings were enclosed in ferrite 'pots'.

Some traps

The position of iron cores in transformers wound on a common former is important. These transformers can be recognised by their having an adjustment screw at each end. As can be seen in Fig.4, there are two positions of each core, one either side of its winding, where the inductance and tuning will be correct, providing four possible combinations of core positions. These positions can considerably influence the coupling between primary and secondary, with significant changes to the bandwidth.

Individual transformers vary, and if at all possible, the manufacturer's alignment instructions should be obtained and carefully followed. Transformers with in-line windings, and which can be recognised by their adjusting screws being at the sides of the cases, do not have this problem and it was probably a major reason for their introduction.

Special types

Most IF transformers have the conventional pair of windings, but occasionally other patterns will be encountered. Sometimes only the primary winding will be tuned. This type of transformer is easily recognised by the windings being much closer together than normal, with only one adjustment; or there may be only one winding.

Three-winding IF transformers have been used occasionally. Although tuned, the third winding — used to increase selectivity — has no external connections.

More common are transformers used in some large receivers with *variable selectivity*, a good example being the 1938 Tasma/Genelex 580. As can be seen from Fig.5, a few switched turns of the secondary are wound over the primary winding. When in circuit, coupling between primary and secondary is increased and the tuning broadened.

Servicing IF's

Electrically, IF amplifiers are basically simple, and apart from the usual valve, resistor and capacitor faults, the most common problem is open circuited or 'green spotted' transformer windings. Low frequency IF transformers, generally wound with single strand wire, were very prone to this type of fault.

Open primary windings are easily found — there is no voltage at the anode of the associated valve, and the receiver is very dead. Faulty secondary windings may have sufficient leakage for the receiver to work after a fashion, but performance will be very substandard.

The easiest method of finding open windings is a resistance check, a procedure which should be carried out as a routine anyway. Be suspicious of windings that have significantly higher resistances than their companions. This could indicate that there are broken strands of Litz wire, resulting from a developing green corrosion spot. Alternatively, there may be a bad termination to the winding.

With each fine strand insulated with enamel, Litz wire is notoriously hard to solder. Various methods of removing the enamel have been suggested, but the most reliable is very fine abrasive paper used very gently. Unexpectedly, tests have shown that the effect of a few broken strands is not serious.

Puzzling faults

IF tuning capacitors can provide some puzzling faults. Defective soldering of the leaves of mica compression capacitors can produce intermittent drops in level, and rivets can provide unreliable contacts. Moulded mica capacitors can have intermittent changes of capacitance too, creating frustrating faults.

Ceramic capacitors used with slug-tuned windings can occasionally change to a lower value and provide real traps. The slug appears to go through resonance as it passes through the centre of the coil, but the overall gain remains low. This condition can be recognised by there being only one peak, whereas normally there are two.

Iron cores can become disconnected from their adjusting screws, and move inside the former. The symptoms are an inability to tune the offending winding, and the gain of the receiver can vary if the chassis is tipped or up-ended! It pays

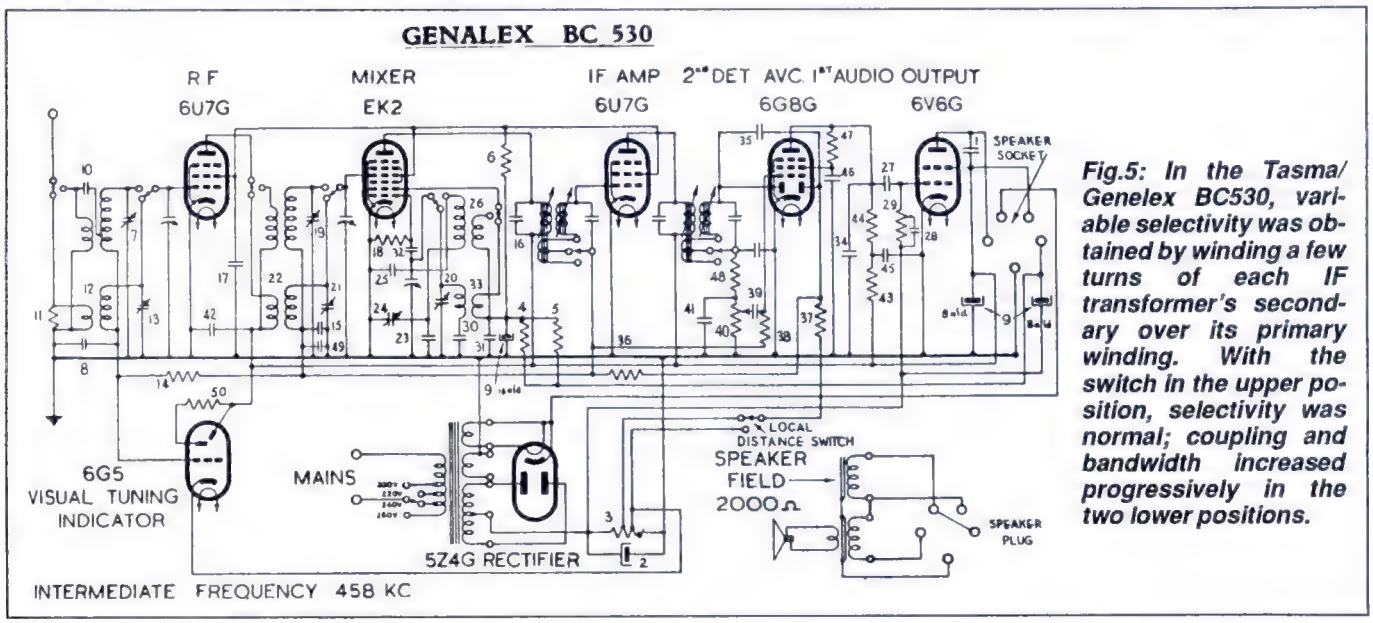


Fig.5: In the Tasma/ Genelex BC530, variable selectivity was obtained by winding a few turns of each IF transformer's secondary over its primary winding. With the switch in the upper position, selectivity was normal; coupling and bandwidth increased progressively in the two lower positions.

to investigate an IF transformer where a tuning control has no effect.

Fitting replacements

Nothing stands out to the experienced eye like a 'foreign' IF transformer. If an exact replacement is not available, it is often possible to insert the internals of another make into the original can. Fortunately, most transformers will operate satisfactorily over a range of frequencies and a unit intended for say 455kHz will usually operate quite well at any frequency from 450 to 470kHz. Never throw out a junked chassis without first salvaging the IF transformers!

When working with IF transformer windings, it is essential to observe the sequence of connections. Swapping the connections of a winding can reduce gain considerably. Assuming that the windings are in the same direction, if a grid or diode lead is connected to the start of one winding, then the anode will be connected to the end of the other winding and vice-versa.

A warning to beginners: IF amplifiers are normally very stable, so do not attempt re-alignment unless you sure that the receiver is otherwise working correctly and you are reasonably sure that settings have been tampered with. Even after many years of use, most IF adjustments will be found to be correct.

Unfortunately though, as any serviceman will tell you, accessible IF alignment screws seem to hold a fatal attraction for non-technical people attempting to get a set working. Many manufacturers sealed adjusting screws with wax, and in these cases, chances are that the alignment will not have been tampered with.

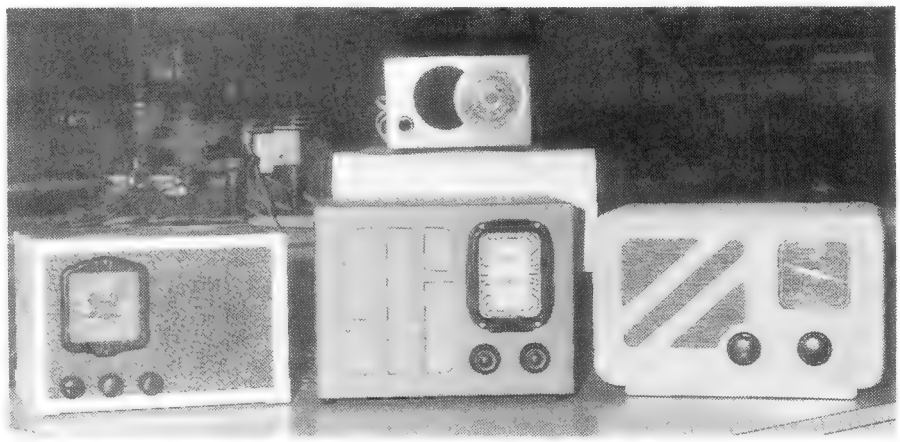
If it really is necessary to realign an IF amplifier, the maker's instructions should be obtained if at all possible. However, in an emergency, and provided that a signal generator is available and the set's intermediate frequency is known, some alignment can be done.

Clip a high resistance digital voltmeter or a vacuum tube voltmeter to the AGC line or diode load resistor. Inject a signal at the set's intermediate frequency into the control grid of the frequency converter, sufficient to give a reading on the meter of between 2V and 3V. Now, keeping the injected signal always at a minimum to give a meter reading, peak each trimmer in succession.

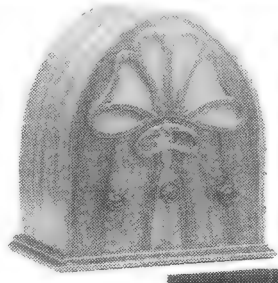
Powdered iron cores are very brittle and are easy to damage irreparably. Therefore, never adjust them with a steel screwdriver, but use a plastic alignment tool or a piece of sharpened plastic knitting needle — or even hardwood. ❖

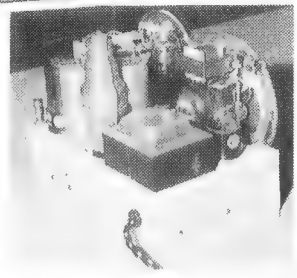
Collector's Corner

Where readers display prized items of radios and other equipment from their collections, and/or seek information from other collectors...



Club members make 'Little General' copies





Rodney Champness, who is publicity officer for the North East Vintage Radio Club (based in Wangaratta, Victoria), tells me that this year the Club members set themselves the challenge of building replicas of the 'Little General' receiver, first described by John Moyle in the April 1940 issue of this magazine. He says that the idea of doing so came from the articles we ran last year by both Peter Lankshear and Neville Williams, telling the story behind the design.

The set judged best was to be awarded the Club's annual Hellier Award, — named in honour of Mr Les Hellier, who built the town's radio station 3WR and began broadcasting on the 25th February, 1925 (it was apparently the first licensed station in any of Australia's country towns).

Some 16 Club members accepted the challenge, and set about scrounging parts, making chassis and building cabinets.

When judging took place, the winning set was a replica of the 1947 Little General built by Ralph Robertson, of Kyabram, and pictured both in the front centre of our main shot above and at lower right. The other sets in the main shot are (top centre) Rodney's own version of the 1957 model, which won second prize; (left) Noel Meagher's version of the 1961 model; and (right) Bob Young's replica of the 1947 model. The last two sets tied for third place.

At upper right is a shot of another Little General built by a Club member, and housed in a 'cathedral' style cabinet. Rodney says that the builder is a skilled woodworker, and the cabinet is 'magnificently finished'.

Rodney says that the NEVRC caters for anyone with an interest in early radio, from technical and restoration work to collection of magazines and recordings, etc. Further information is available by writing to him at 17 Helms Court, Benalla 3672, or phone (057) 62 1454. ❖

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

June 1943

Clearer than glass: Plastic materials are being used in increasing quantities in the manufacture of numerous articles. An American aeroplane has been moulded in two parts from hardwood veneer impregnated with a modern plastic. Chemists have succeeded in synthesising resins from simple chemicals like coal and oil.

The first to appear on the market was acrylic resin, in 1935. This plastic can transmit light through its curved forms, and is even clearer than glass. It may have a big future as a substitute for glass.

Australia's mica field: Australia is almost self-sufficient in mica, as a result of developmental work carried out by the Allied Works Council in Central Australia. The field developed is 150 miles north-east of Alice Springs, and is believed to be the biggest mica field in the world. Mica is used extensively in plane and radio manufacture.

June 1968

Colour TV radiation: The US National Council on Radiation Protection and Measurement has issued an interim statement on the problems of X-ray radiation hazards from colour TV receivers. In 1959 it recommended that the exposure rate near the surface of any domestic TV receiver should not exceed 0.5mR per hour under normal operating conditions. Changes in TV receiver design mean that some sets are now outside this limit.

Originally, the main source of X-rays was the front of the picture tube. More recently, rectifiers and voltage regulators have become of greater significance, and radiation from these components is sometimes in relatively narrow beams.

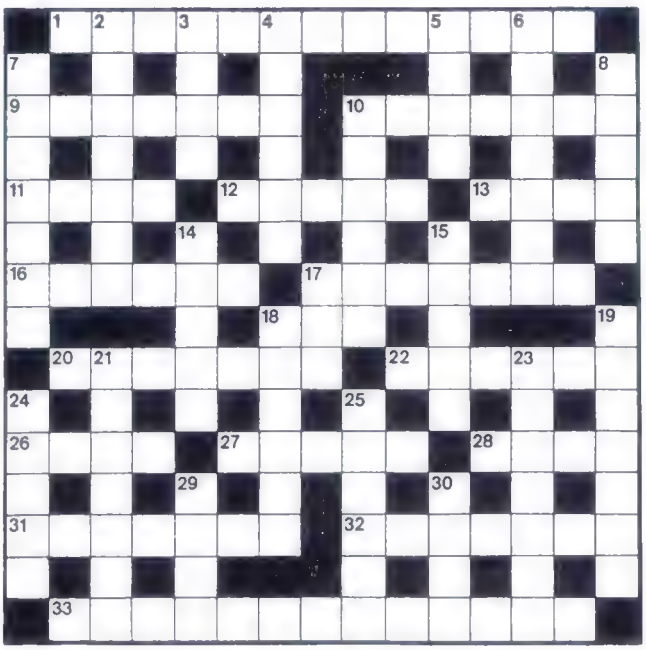
The statement stresses that a small increase in potential can result in a large increase in exposure rate. As an example, it states that increasing the EHT from 25 to 30kV may increase exposure rates by 10 to 20 fold.

Unveiling ceremony: On April 20, 1911, Lieutenant (later Major) George Taylor transmitted the first military wireless signal in Australia. On April 20, 1968 the event was commemorated by a memorial plaque in Veno Park, Heathcote, south of Sydney, which was at one time part of the military area where Major Taylor conducted his experiments.

Before he died in 1928, Major Taylor was very active in many branches of the arts and sciences. His other achievements included the first glider flight in Australia, in a machine which he built himself, an event commemorated by a plaque at Narrabeen where the flight occurred.

Language laboratory: The Japanese ambassador officiated at the opening of a new language laboratory at the University of NSW on April 16, 1968. Supplied and installed by Amalgamated Wireless in the Institute of Languages, the Sony Language Laboratory (manufactured in Japan) has facilities to give oral instruction in foreign languages to 30 students at any one time. ❖

EA CROSSWORD



ACROSS

1. Name given to US electronics-based region. (7-6)
9. Derived notion. (7)
10. Mathematical determination of Earth's shape. (7)
11. American space organisation. (4)
12. Laboratory seat. (5)
13. Uranium is a nuclear ——. (4)
16. Induced currents. (6)
17. Changes format of data. (7)
18. Conductor between components of a system. (3)
20. Formed as a measuring network. (7)
22. Source of a navigational signal. (6)
26. Significantly close asteroid. (4)
27. Business-oriented computer language. (5)
28. Quality reproduction. (2-2).
31. Integration of phenomena, the —— field theory. (7)
32. Direction of satellite launch. (7)
33. Electronic safety device with alarm. (5,8)

DOWN

2. Charged. (7)
3. Mental inspiration. (4)
4. Stable groups of electrons in atoms. (6)
5. Wiring harness. (4)
6. Put program into effect. (7)
7. Electronic device for snoopers. (7)
8. One of a series of recurring changes. (5)
10. Lamps. (6)
14. Unites by fusion. (5)
15. Phonetic word for 8th letter. (5)
17. Faulty component. (3)
18. Meaning of prefix in UV. (6)
19. Disassembles a coil. (7)
21. Metal used in electroplating. (7)
23. City of first controlled fission reactor. (7)
24. Spacecraft Magellan scanned this planet. (5)
25. Satellite communications agency. (6)
29. Electronically produced sound, —— noise. (4)
30. Abbreviation indicating coincidence in time. (4)

SOLUTION FOR MAY 1993

E	N	G	I	N	E	E	R	■	M	A	N	U	A	L
I	■	■	O	■	T	■	S	■	T	■	N	■	E	■
N	E	M	A	T	I	C	■	T	R	O	L	L	E	Y
S	■	I	■	E	■	H	■	A	■	M	■	O	■	D
T	E	X	T	■	M	E	L	T	S	■	S	A	F	E
E	■	U	■	O	■	D	■	I	■	A	■	D	■	N
I	M	P	U	R	E	■	H	O	T	N	E	S	S	■
N	■	■	■	B	■	V	■	N	■	I	■	■	■	R
■	A	C	T	I	N	I	C	■	M	O	B	I	L	E
M	■	R	■	T	■	O	■	U	■	N	■	N	■	S
I	R	I	S	■	B	L	A	N	K	■	T	E	L	E
R	■	M	■	W	■	I	■	S	■	D	■	R	■	A
R	E	P	L	A	Y	S	■	A	V	I	A	T	O	R
O	■	E	■	R	■	T	■	F	■	A	■	■	■	C
R	A	D	O	M	E	■	B	E	L	L	■	P	U	S	H

EA with ETI marketplace

ADVERTISING RATES FOR THIS PAGE

SMALL ADS: The minimum acceptable size of 2 centimetres x one column costs only $50. Other sizes up to a maximum of 10 centimetres are rated at $30 a centimetre. **CLASSIFIEDS:** $4 for 40 letters. Just count the letters divide by 40 and multiply by $4, ROUND UP TO THE NEAREST WHOLE NUMBER. **CLOSING DATE:** Ads may be accepted up to the tenth of the month two months prior to issue date. **PAYMENT:** Cheque or money order only. Please enclose payment with your advertisement. Address your letter to: **THE ADVERTISING PRODUCTION MANAGER, ELECTRONICS AUSTRALIA, P.O. BOX 199, ALEXANDRIA NSW 2015**

FOR SALE

PAY T.V. AND SATELLITE SCRAMBLING NEWS MONTHLY: Always with the latest on descrambling technics and address where to buy the latest descramblers. 12 issues only $40 posted. John Papp Box. 37885 Winnellie, 0821, N.T.

VIDEO HEADS "HQ" JAPANESE HIGH QUALITY – HIGH OUTPUT:

Up to 64%	Less than some Japanese Heads	
Up to 41%	Less than some Non Japanese	
AKAI	BV-1030A220D	$29
AKAI	BV-V1017A170A	$29
GOLDSTAR	413-050	$29
AWA	928B09004	$36
HITACHI	5458104	$33
SONY	DSR-36R	$41
NEC	82423AH1	$33
NEC	82434AH1	$55
FUNAI	8000-01-13	$29
TEAC	8059-01-19	$29

This is a sample of our Tax Inclusive Prices Need an Unusual/Expensive Head ie. AWA3000? We Will Get It!! Ph/Fax Now for Price List Allthings Sales and Services (09) 349 9413.

AMIDON FERROMAGNETIC CORES: For all RF applications. Send business size SASE for data/price to RJ&US Imports, Box 431 Kiama NSW 2533. Agencies at Geoff Wood Electronics, Sydney: Webb Electronics, Albury: Assoc. TV Service, Hobart: Truscott Electronics, Melbourne.

UNUSUAL BOOKS: Electronic Devices, Fireworks, Locksmithing, Radar Invisibility, Surveillance, Self-Protection, Unusual Chemistry and More. For a complete catalogue, send 95 cents in stamps to: VECTOR PRESS, Dept E, PO Box 434 Brighton SA 5048.

TRANSFORMER REWINDS
ALL TYPES OF TRANSFORMER REWINDS
TRANSFORMER REWINDS
Reply Paid No.2, PO Box 438 Singleton, NSW 2330. Ph: (065) 76 1291, Fax: (065) 76 1003

TORTECH PTY LTD
TOROIDAL TRANSFORMERS
Design and Manufacture
Approved to AS3108 - 1990 & U.L. Standards
Tel:(02) 642 6003 Fax: (02) 642 6127

WEATHER FAX PROGRAMS: For IBM XT/AT's *** "RADFAX2" $35, is a high resolution, shortwave weather fax, morse & RTTY receiving program. Suitable for CGA, EGA, VGA & Hercules cards (state which). Needs SSBhf radio & RADFAX decoder. *** "SATFAX" $45, is a NOAA, Meteor & GMS weather satellite picture receiving program. Needs EGA or VGA, & "WEATHER FAX" PC card. *** "MAXISAT" $75 is similar to SATFAX but needs 2mb of expanded memory (EMS 3.6 or 4.0) & 1024 x 768 SVGA card. All programs are on 5.25" or 3.5" disks (state which) + documentation, add $3 postage. ONLY from M. Delahunty, 42 Villiers St, New Farm 4005, Qld. Ph (07) 358 2785.

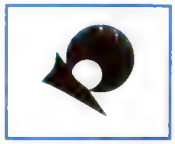
PLANS FOR 1KW LOW-REVVING BRUSHLESS GENERATOR: - "The Homebuilt Dynamo" details, call Al Forbes, 0011-649-818-8967

KITS ASSEMBLED OR REPAIRED: Low rates. Contact Autronics on (08) 294 8591

KIT REPAIRS – R&D, Prototyping repairs to electronic equipment all kits repaired
CAMPAD ELECTRONICS
2/25 Veronica Street, Capalaba Qld 4157 (07) 245 2008

T.V.YOKE EXCHANGE
Prompt service.
Refer transformer rewinds this page.
Phone (065) 761 291
Fax (065) 761 003

We pay high price for your excess/obsolete components. We accept ICS, transistors, capacitors, connectors etc. etc



Yuga Enterprise Electronics
#01-63, Kempas Road Blk 11, Singapore 1233
Tel: (65) 299 0908 Fax: (65) 299 1048

PCB DESIGN PROGRAM: Micro PCB only $60 for IBM XT/AT or compatibles with 1.2MFDD, 640K RAM, EGA/VGA. Draw PCB or Schematics, Make PCB or Sch components. PCB components included. Drivers for most printers/plotters, user definable sizes. 40 page manual. Add $10 for delivery, send cheque payable to G. Georgopoulos. 34 Scouller St Marrickville NSW 2204.

B40 RECEIVER: Working and original condition $150 (03) 793 3363.

AN INTERFACE: to control the outside world from a PC parallel port. 32 bits in. 32 bits out. Units can be cascaded. Short form kit inc. software examples $35 or send $2 for my 3.5" promo disk. Don Mckenzie 29 Ellesmere Cres Tullamarine 3043

WANTED

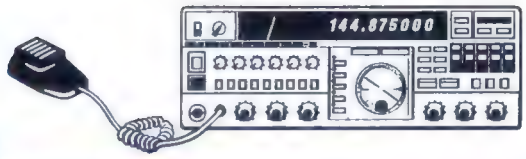
RADIOTRON: Designer's handbook and any information on valve amplifiers and valves or photo copies of same. Noel Watson 45 Horseshoe Bend Gympie 4570. Ph 074 821 869 after 6pm.

KIT REPAIRS
Kits repaired from all magazines.
Switchmode power supplies repaired.
Design work from start to finish.
Computer software consultancy.
Ring anytime 9am-9pm Mon-Sun
EEM Electronics
10 Bouverie Place, Epping Vic 3076
(03) 401 1393

RCS RADIO PTY LTD
Established 1933
IS THE ONLY COMPANY WHICH MANUFACTURES & SELLS EVERY PCB & FRONT PANEL
published in EA & Silicon Chip.
651 Forest Road. Bexley 2207
AUSTRALIA
RING (02) 587 3491 FOR INSTANT PRICES.

FIX-A-KIT
KIT REPAIR AND CONSTRUCTION
3 months warranty on repairs
12 months warranty on construction.
technical assistance.
HYCAL ELECTRONICS
Design, Manufacture, repair of electronic equipment
(02) 633 5477

Amateur Radio News



SE Radio Group Annual Convention

South Australia's South East Radio Group, based in Mount Gambier, has advised that this year its popular Annual Convention will be held over the weekend of June 12-13.

The programme includes many events of interest, including the very popular Australian Fox Hunting Championships and the Home Brew Competition. The range of events is carefully planned to cater for everyone, from Novice to Expert levels.

Further details, including information on recommended motels and caravan parks in the area, is available from the Convention Co-ordinator, SERG, PO Box 1103, Mount Gambier 5290.

New Club in Parramatta

A recent broadcast by the WIA's NSW Division advised that a new club for amateur radio and electronics enthusiasts has been established in Parramatta. Called the Parramatta Amateur Radio Club, it's apparently been formed by the people who attended the Amateur Radio Class of 1992 at the WIA's Amateur Radio House in Wigram Street.

The first meeting was held at 109 Wigram Street on May 7, and it is hoped that the Club will provide an opportunity for both amateur radio and electronics enthusiasts to meet and share some of the more practical aspects of their hobby.

Ron Wilkinson Award winner

The WIA's General Manager Bill Roper, VK3ARZ has advised that the winner of the prestigious Ron Wilkinson Award for 1992 was Gordon MacDonald VK2ZAB of Berowra Heights, a northern suburb of Sydney.

Given for 'special achievement in any facet of amateur radio', the Award honours the memory and achievements of the late Ron Wilkinson VK3AKC.

Gordon VK2ZAB has been a long-time pioneer in terrestrial weak-signal, long distance VHF and UHF communications techniques, particularly in recent years in what is now referred to as 'aircraft enhancement' propagation. For some 10 years, he has kept regular schedules on VHF and UHF bands with other stations in Canberra, Melbourne, Brisbane and other distant points, seeking to experiment with and exploit the signal enhancement afforded by high flying passenger aircraft passing through roughly the mid-point of the path between two stations.

In that time he has developed the mode from an experimental, almost 'hit-or-miss', exercise into a routine method of working interstate as far as Melbourne and Brisbane, from Sydney, on both 144MHz and 432MHz. Until the early 1980's, when Gordon started work in earnest on the mode, these paths were considered 'impossible' to bridge on these bands using terrestrial propagation.

Writing in *Amateur Radio*, Bill notes that Gordon's strategic efforts as a 'Sydney anchor' over the past decade have contributed much to scientific knowledge on this propagation mode, clearly outweighing work contributed by amateurs in the USA and Europe, and sparking off others to write and publish technical papers on the propagation expressing differing technical points of view. ❖

RS-232C Adaptor

Continued from page 76

the two switches on the lid of the box and then solder the three wires to the switches. Make sure the poles of the switches are joined together. The wire marked P should go to the poles of the switches, while the wires marked S1 and S2 should be connected to the other contacts of switches S1 and S2 respectively.

The two cables needed to operate the data monitor are made from ribbon cable. I made the cables approximately 0.5m long, but you can cut lengths to suit your application. To make the cables use Fig.1 as a guide.

The main thing to note is that the number 1 pin on the connectors for each cable should use the same conductor. This is usually a red coloured conductor, while the others are gray in colour.

The cable between the monitoring computer and the data monitor simply involves crimping a male and female 25-way D connector to each end of the ribbon cable. To construct the cable that is between the data monitor and the RS-232C link you wish to monitor, crimp a male and female 25-way D connector 100mm apart at one end of the ribbon cable and then crimp a female connector at the other end, to connector to the monitor.

PARTS LIST

Semiconductors

1 Si7661 voltage converter
1 14C88 CMOS RS-232 driver
2 BC548 transistors
2 1N4148 diodes

Capacitors

3 10uF 25V tantalum capacitors

Resistors

All 5% 0.5W carbon: 2 x 10k, 2 x 22k, 1 x 56k

Miscellaneous

1 25 way female D connector, solder type
1 25 way male D connector, solder type
3 25 way female D connector, IDC type
2 25 way male D connector, IDC type
2 0.5m lengths of 25 way ribbon cable
1 Plastic case measuring 67 x 130 x 42mm
2 SPST miniature toggle switches
1 PC board, 57 x 39mm, code 93sdm6

Testing it

The circuit is fairly simple and should work without any difficulty but if it doesn't, first check that the capacitors, diodes, transistors and integrated circuits are orientated correctly. If this is not the problem, test that the RTS and DTR pins (pins 4 and 20) on the female connector are positive and are between 5 and 15 volts. This shows that the monitor adaptor is receiving power from the monitoring PC.

If the voltage isn't present, check that the software running on the laptop is configured and running correctly. If the pins are positive, then check that the Si7661 is producing at pin 5 a negative voltage approximately equal in magnitude to the positive supply voltage on pin 8.

Assuming everything checks OK so far, close both switches. Confirm with an oscilloscope that the signal at each collector varies between 0.2V and the positive supply voltage when a signal varying between the RS-232C levels (or even between 0V and +5V) is applied to pin 2, and also pin 3 of the DB25 male connector. If this doesn't happen in both cases, replace the respective transistor, or check the base resistors for an incorrect value.

If you're getting the correct voltage variation at point P in response to signals at pins 2 and 3 of the male DB25, the remaining thing to check is that the signal produced at the output of the 14C88 driver is a true RS-232C version of this signal. Replace the 14C88 if it is faulty.

Otherwise, your RS-232C serial data monitor should be ready for business. All you have to do is connect it up, and run your preferred data communications program on the monitoring computer, to see what is happening on either line 2, or line 3 of the RS-232C link being monitored. ❖

Electronics Australia's

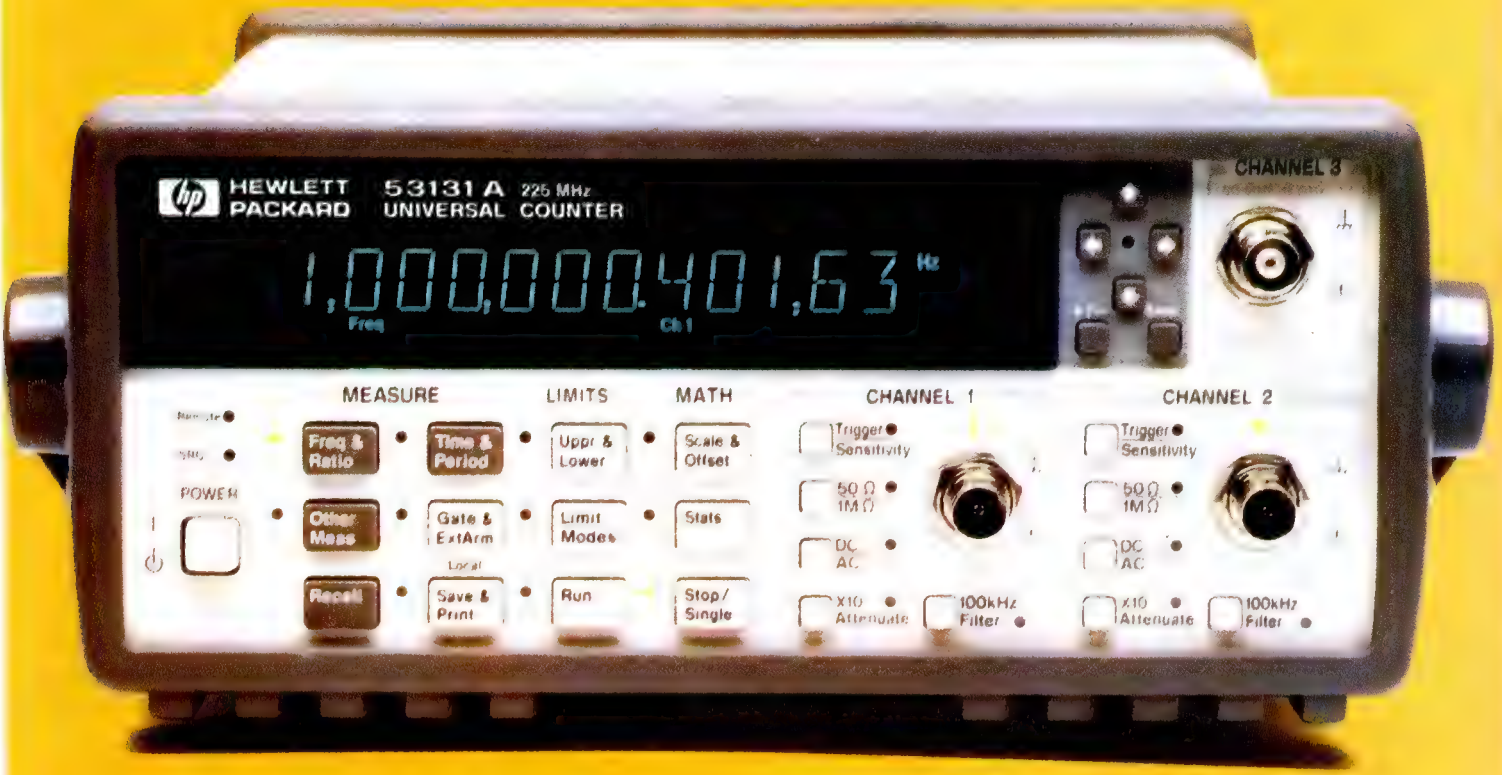
Professional Electronics

S · U · P · P · L · E · M · E · N · T

SYDNEY MEETING OF MPEG DEFINES MPEG-2 MAIN PROFILE

REVIEW OF LOW COST AUSTRALIAN-DESIGNED 'PLUG & PLAY' GPIB ADAPTOR FOR PC'S

FEATURE: THE LATEST TEST INSTRUMENTS



H-P'S NEW 53131A UNIVERSAL COUNTER: FULL SYSTEM FUNCTIONS WITH BOTH HP-IB & RS-232C, TWO 225MHZ MAIN CHANNELS — PLUS AN OPTIONAL 3GHZ CHANNEL

NEWS HIGHLIGHTS

MPEG MEETING IN SYDNEY

In late March, a meeting of the ISO/IEC Moving Picture Experts Group (MPEG) was hosted in Sydney by Standards Australia, and achieved its stated goal of defining the MPEG-2 Video Main Profile, for compressed digital video.

Important progress was also made towards developing a multi-channel audio coding standard, by merging several previous proposals into a single unified proposal.

In its work on the MPEG-2 Systems Standard, MPEG created an initial specification for multiplexing multiple audio, video and data streams into a single stream for the transmission, storage and access management required for many applications.

These achievements signal the convergence of such diverse industries as broadcast (including cable, satellite and terrestrial), telecommunications, entertainment and computing to a single, worldwide digital video coding standard for a wide range of applications, including standard definition, high definition and low definition TV.

MPEG confirmed that it is on schedule to produce by November this year Committee Drafts of all three parts of its MPEG-2 Standard — Video, Audio and Systems — for ratification by its member countries.

The Group is also working with the CCITT Study Group XV 'Experts Group on Video Coding for ATM Networks', as well as representatives of the EBU, CCIR and SMPTE to ensure that a harmonised solution to the widest range of applications is achieved.

NSW TAFE CENTRE OFFERS COURSES

The Advanced Manufacturing Technology Centre situated in the Lidcombe campus of the Southern Sydney Institute of TAFE is now offering training in sought-after areas of printed circuit board design, assembly and testing, using an extensive range of equipment installed in a modern complex. The AMT Centre is very well equipped, providing resources for students to receive hands- on experience in CADD (computer aided drafting and design), CAM (computer aided manufacturing), robotics, mechatronics, flexible manufacturing, CIM (computer integrated manufacturing), fashion apparel CAD and electronics assembly manufacturing.

Enrolments are available in mid-July 1993 for two short courses which should

RF LINKS BOOST APPLE THROUGHPUT

A highly efficient warehouse despatch system using barcode technology which was installed at Apple Computer Australia in December 1989, has recently received an additional 40% productivity boost through the use of the latest technology in RF data communications.

Rapidly growing sales and stock movements over the past three years forced Apple to look to an upgrade of their system, in order to maintain their inventory management efficiency. Apple product sales have increase dramatically since 1989 when the original system was first implemented, climbing from around $100 million a year to more than $240 million last year. Outbound shipments have risen from around 200 cartons a day originally up to 1000 plus units a day, a level which highlighted a bottleneck in the previously smooth-flowing warehouse floor data collection system.

The cause of the bottleneck was the need to physically connect and batch transfer data to the boost computer, which in turn slowed down the validation process of order picking on the warehouse floor.

In adopting the new wireless form of data communications where collected data is instantly validated without any interuption to order picking operations, Apple has dramatically reduced the time taken for validation of order picking and hence increased its overall despatch management capabilities — as well as opening up further potential for the system in other areas such as the service department.

Once the order is fully picked, the barcode labels on each carton are scanned using Intermec Trakker portable data managers and this information containing order and customer details is relayed back to the host computer, together with information including serial numbers for warranty registration.

The introduction of RF communications has necessitated upgrading the original Intermec 9440 Trakkers for the latest 9465 RF Trakkers, which still connect to the previously used Intermec 1545 laser scanners. Apple have also changed their computer arrangement, now choosing to use the new Macintosh Quadra 950 as the warehouse floor operating system into which is downloaded all wave planning details from the main computer system.

appeal to those interested in careers in electronics manufacturing. The first course is *Printed Circuit Board CADD* (using Protel software), and the second is *Printed Circuit Board Assembly*. Each course is available for either day or evening attendance.

The PCB CADD course provides an integrated approach to PCB design, and assumes no previous experience. However it would also be of value to those with some experience with PCB design software, who wish to enhance their skills. Each student has access to a dedicated PC throughout the course, which covers both through-hole and surface mount boards and progresses from simple single-sided designs to full multilayer designs. Students produce a complete design, and have access to a PC-controlled PCB router/milling machine for prototype production.

The PCB Assembly course covers the entire sequence of assembly, testing and rework for a predominantly surface-mount PCB assembly. Students program an automatic pick and place machine, perform solder paste stencilling and use an infra-red reflow oven. Experience is also gained in laser-guided manual insertion of leaded components, the use of automatic PCB testing equipment and rework of a PCB assembly for a microprocessor-based car alarm.

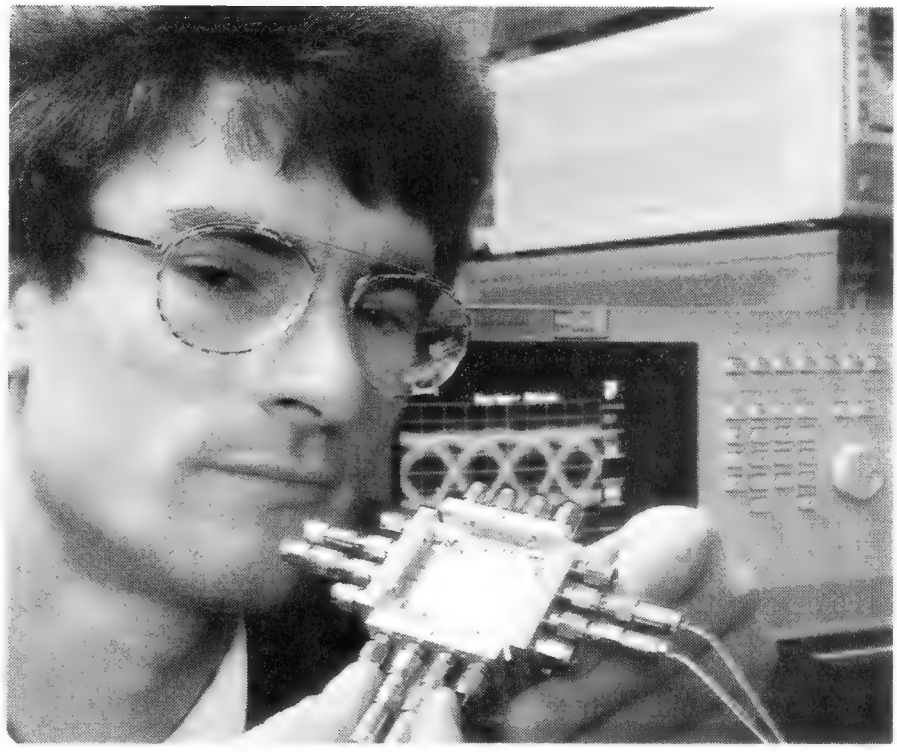
Current enrolments in these courses include service personnel and hobbyists, as well as students in various electronics courses.

Further information regarding the courses is available from John Fenton at the AMT Centre on (02) 749 3377, or by post to PO Box 142, Regents Park 2143.

DIGITAL VCR, LD PLAYER DEVELOPED

Samsung Electronics of Korea has announced the development of a prototype domestic digital VCR, accepting standard NTSC video signals and recording them digitally on 8mm video cassettes. The recording density achieved is approximately eight times that of standard FM recording, giving up to four hours of recording. Video horizontal resolution of 440 lines has been achieved, with an audio dynamtic range of 90dB. No details of the coding or compression system used have been given.

Samsung has also announced the development of a prototype domestic digital laserdisc recorder, which uses a second-harmonic green laser with an output at 532nm to record and play back up to 110 minutes of video on both sides of a 130mm diameter magneto-optical disc.



In the very centre of the assembly visible in the scientist's hands is a tiny chip, developed at the Siemens Research Centre in Munich. This same chip recently set a new world record for processing speed, of an incredible 40 gigabits/second.

The recorder uses MPEG-2 coding and compression and records in CLV (constant linear velocity) mode with a data transfer rate of 7.6Mbps. The company apparently has plans to begin marketing a production version of the recorder in 1995, with an estimated price of around US$1250.

NEW IREE SOCIETY COMMS CONFERENCE

The IREE has announced that the first of a 'new style' of Communications Conference is to be held in October 1993 in Melbourne. With the title 'Communications: Foundations for the Future', the conference has been planned in co-operation with AOTC, Optus and the AAEMA, and will present targetted and carefully selected speakers.

The keynote address will be given by Mr Arnold Ph Djiwatampu of Indonesia, the newly-elected first Director of the Telecommunications Development Bureau (BDT) — the ITU's development arm. Conference Chairman Dr Bob Horton of Austel says that "Mr Djiwatampu's plans and strategies for regional and global development of communications within the ITU will create opportunities for countries like Australia within the region".

The conference itself will consist of 'invited papers' only, and will consist of three critical and complementary streams of presentations each day. A 'Hypothetical' session is also planned as an interesting highlight, while the conference will also be accompanied by an exhibition by organisations and traders.

The Conference will be held at the Hilton International Hotel in Melbourne, from Sunday October 24 to Wednesday October 27, 1993. Further information is available from the IREE's Executive Director Heather Harriman, or Convention Administrator Cherie Morris, on (02) 327 4822 or fax (02) 362 3229.

1993 ATERB SCHOLARSHIPS

The Australian Telecommunications and Electronics Research Board (ATERB), which is jointly sponsored by AOTC, CSIRO and DSTO, has again awarded nine one-year postgraduate scholarships to promote research and training in the area of telecommuncatgions. The scholarships are each valued at $11,000 tax free. The 1993 winners and their research topics are as follows:

Leslie Bright (University of Adelaide), Algorithmic Techniques for Obtaining Performance Measures in Communications Systems.

Geraldine Fitzpatrick (University of

Queensland), Harnessing the Potential of Computers for the Co-ordination of Team Work in a Distributed Environment.

Eric Heyde (University of Sydney), Optical Signal Processing for Telecommunications Transmission Systems.

Brendan Jones (Macquarie University), Service Quality of Digital Microcellular Communications Systems.

Stephen Lawrence (University of Queensland), Recurrent Neural Networks with Application to Speech Recognition and Speaker Verification.

Michael Steel (University of Sydney), Theory and Applications of the Optical Pushbroom.

Jacqueline Walker (Curtin University of Technology), Signal Processing Applied to Communications Network Timing.

Craig Watkins (Australian National University), New Techniques in Signal Coding.

Samson Yeung (University of Melbourne), Petri Nets in the Design of Digital Communications Systems.

FLUX EXPERT COMING TO SYDNEY

Internationally recognised expert on soldering fluxes, cleaning and reliability Dr Laura Turbini has agreed to be a major speaker at the annual international conference Surface Mount 93, planned to take place in Sydney the first week in September. Dr Turbini is a Principal Research Scientist and adjunct faculty member in the School of Materials Science at Georgia Tech, in Atlanta, and until recently she was also the Associate Director for Technical Programs in the Manufacturing Research Centre (MARC). She also spent 12 years working for AT&T as a researcher and research leader in soldering processes, fluxes and cleaning issues.

Surface Mount 93 is being organised by the Surface Mount and Circuit Board Association (SMCBA), which has also produced a directory of information on companies offering through-hole and surface mount electronics assembly, prototyping, testing, rework, component sourcing and repair services. Company information provided includes contact details, services offered, equipment available and certifications attained.

The Directory is free of charge, and updates to it are also provided by the SMCBA at no cost. Copies of the Directory and also further information about Surface Mount 93 may be obtained by contacting SMCBA Executive Officer Dianne Hunt; phone (03) 569 6393, or fax (03) 569 1047.

The Munich Transport Authority in Germany is taking delivery of 70 of these modern low-floor trams, which feature state of the art traction and control equipment. This includes 32-bit microprocessor equipment supplied by the Transportation Systems Group of Siemens, who supplied the photo.

TRADE MISSION TO THE USA

The American Chamber of Commerce in Australia (AmCham) is offering a limited number of places in a Trade Mission to the USA, planned for October this year. The mission is to concentrate on Medical and Scientific Technology, and will visit centres in San Francisco, Minneapolis, Philadelphia and San Diego — all selected for their concentration of companies at the leading edge of medical and applied scientific research.

Each participating company will be provided with individually prepared itineraries based on a series of appointments with potential business partners. The AmCham network offers an unmatched access to the US marketplace, allowing identification of those potential partners where mutual benefit is most likely. In this way, mission delegates will be able to meet prospective business partners in a concentrated two week schedule.

The mission will depart Australia on October 2 and return about October 17. Further details are available from AmCham's mission co-ordinators by writing to Suite 4, Gloucester Walk, 88 Cumberland Street, Sydney 2000; phone (02) 241 1907, or fax (02) 251 5220.

SONY BOOSTS HDD CAPACITY

Sony in Japan has developed a technique of squeezing considerably greater amounts of data onto a magnetic hard disk platter, by using embossed circular grooves with reference pits between the data tracks, to gived improved head tracking.

The technigue has allowed Sony to produce a disk with 200 tracks per radial millimetre, with the individual tracks 5um wide — but as the tracking accuracy achieved is around 0.5um, the company is confident that it will soon be able to achieve track densities three times higher.

A prototype demonstrated in Japan recently stored 200MB of data on a single platter 64mm in diameter (the size used in many laptop computers). If the goal of 600 tracks/mm is achieved, this will give a capacity of around 1.5GB on the same size of disk.

NILSEN INSTRUMENTS ACQUIRES ELMEASCO

Nilsen Instruments has taken over the business of Elmeasco Instruments. Nilsen Instruments' strengths have always been in the electrical test and measurement and distribution areas, and more recently with the acquisiton of Parameters, in the data acquisition and ATE fields.

The takeover of Elmeasco will give Nilsen a solid base in electronics test and measurement, and computer peripheral product groups. All the agency lines that Elmeasco handled have been transferred to Nilsen Instruments, along with the skilled sales and support staff.

Included with the current product ranges, Nilsen Instruments has also acquired the NATA Standard laboratory, which will continue to offer full calibration facilities to the existing Elmeasco customers, as well as provide Nilsen customers with this new accredited service.

KOREAN CELLULAR MAKERS GO CDMA

Four major Korean manufacturers — Goldstar Information & Communications, Hyundai Electronics Industries, Maxon Electronics and Samsung Electronics — have each signed agreements with Qualcomm Incorporated for the joint development of cellular telephone subscriber and infrastructure equipment based on the latter's Code Division Multiple Access (CDMA) technology for use in Korea.

Under the agreements, the four companies will pay Qualcomm preliminary fees totalling approximately US$5 million, which will be applied against part of their future licensing fees to manufacture and market CDMA cellular telephone equipment for the Korean and other markets.

The four major Korean cellular telephone equipment manufacturers were selected by the Electronics and Telecommunications Research Institute (ETRI) of Korea to participate in the implementation of CDMA technology in that country, based on an evaluation of submitted proposals and an assessment of their ability to develop full scale CDMA production capability.

All four Korean manufacturers signed joint development agreements with ETRI in January and by signing agreements with Qualcomm, which will now begin their participation in the joint ETRI/Qualcomm project.

Maxon will produce subscriber equipment only, while the other three companies will develop both subscriber and infrastructure equipment.

NEWS BRIEFS

- Klaus Lahr has been appointed as Chairman and Managing Director of ***Siemens***, and Barry Roberts has been elected to full Director on the Board. These appointments follow the retirement of external directors Les Bradley and Theo Wagner.
- ***Thomas Electronics*** has been appointed as exclusive distributors in Australia and New Zealand for the fibre optic systems of Meret Optical Communications of Santa Monica, California.
- To improve its customer service, ***Yokogawa Australia*** is changing its organisational structure. Mr M. Morishima becomes Chairman of the company, and is replaced by Mr Peter Smith as Managing Director.
- ***Maxtor***, manufacturer and marketer of high performance Winchester and optical data storage products, has opened an Australian office in Sydney's Bondi Junction. Its address is Suite 103, 55 Grafton Street, Bondi Junction 2022; phone (02) 369 3662, fax 369 2082.
- The microprocessor distributor, ***Email Electronics*** has been appointed as an authorised reseller for the Compaq range of PCs and printers. Also, Email's NSW Sales Branch has moved from Granville to 10 Stoddart Road, Prospect 2149; phone (02) 896 4744, fax 896 4795.
- Lee Collard, National Service Manager at ***Tech- Rentals***, recently won the top personal award from the Association for Service Managers International (AFSMI). Lee was selected from around 4000 members of the Americas and Pacific Rim countries.
- ***Kenwood*** has announced major management changes within the company. Mr Ray Hobson is now General Manager, and Mr Paul Wilcox and Mr Brian Bean are Assistant Sales/Marketing Managers. The NSW, Queensland and Victorian State Managers are Peter Endrey, Malcolm McIntosh and Greg Hede, respectively. New Sales, Technical and Marketing Co-ordinators are Daniel Madden, Ian Dougherty and Bambi Yeend.
- Jon Ariza is the field support engineer for ***National Instruments***'s new support office recently opened in Sydney. Its address is PO Box 382, North Ryde 2113; phone (02) 878 6758, fax 878 6761. ❖

NSW BACKS F-O RESEARCH

The New South Wales Government has provided funds for the establishment of a special laboratory to develop new optical fibre products, predicted to fuel a communications and information technology revolution and a major new industry of the next century.

Minister for State Development Peter Collins QC has presented a cheque for $240,000 for the laboratory to the Chairman of the Australian Photonics Cooperative Research Centre, Sir Robert Cotton, at Sydney University.

The new Product Incubator Laboratory will contribute to the work of the Australian Photonics CRC which is a seven year, $100 million national research programme into optical fibre technology.

Mr Collins said the new laboratory was an innovative move to simplify the development of prototype products in facilities located on the doorstep of the nation's most concentrated fibre optic research efforts.

"The Product Incubator Laboratory's unique location — adjacent to the CRC's research laboratories in the Sydney University's Optical Fibre Technology Centre — will mean greater interaction and better communication between research research workers and industry technicians."

"It will provide and promote the opportunity for the transfer of technology and skills between commercial operators and the research community through closer links which will have consequent benefits for Australia's manufacturing industry."

SIEMENS CHIP PLANT IN SINGAPORE

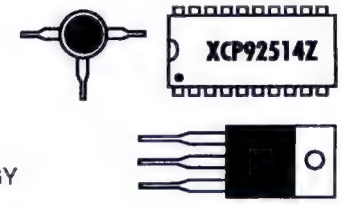
Siemens has opened a new factory for chip assembly in Singapore. The 32,000m^2 facilities, which were custom built to Siemens specifications, represent state of the art with regard to production flow and shop floor arrangement to ensure maximum productivity.

Around 1000 employees are involved in the back end production of integrated circuits including chip assembly, encapsulating and burn-in, plus testing of every single chip. High capacity testing equipment, capable of conducting millions of tests per second is employed.

The new factory will be responsible for the back-end production of all Siemens ASICs supplied from plants in Regensburg (Germany) and Villach (Austria). The product spectrum includes all application-specific components like picture-in-picture chips for television sets, embedded controllers for IT applications and ASICs for telecommunications systems. A centre of competence has been established at the new factory for the design of integrated circuits, development of test software and the evaluation of new manufacturing technologies. The facilities will also accommodate a team of field application engineers as well as the sales and marketing operation for the Asia Pacific region.

Siemens Components Pte Ltd began its manufacturing operation in Singapore in 1970 and has now reached an annual production volume in excess of S$500 million. ❖

Solid State Update



KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

RF MOSFETs have low feedback

Motorola has added to its second generation of 28V RF power MOSFETs with the introduction of the MRF177 100W UHF transistor and the MRF1730 80W VHF transistor. Because of improved construction techniques, these new devices feature very low feedback capacitances (typically Crss = 10pF). The efficiency, stability and ruggedness of the MRF177 and MRF173 transistors make them ideal for use as broadband amplifiers.

The MRF177 and MRF177M UHF power MOSFETs supply up to 100W of RF power, and operate at any frequency or band of frequencies from DC to 500MHz, including the military band of 225 - 400MHz. Both parts are identical except for their package, with the MRF-177M in a case more commonly referred to as the 'medium GEMINI'. Typical performance characteristics at 400MHz are 12dB gain and 60% efficiency.

Providing an RF output power of up to 100W and operating from DC to 200MHz, the MRF173 and MRF173CQ VHF power MOSFETs include applications as FM broadcast and VHF TV transmitters. The MRF173 device is offered in a 1/2" four lead flange package, while the MRF173CQ is in a six lead flange package. Typical performance characteristics at 150MHz are 13dB gain and 60% efficiency.

For further information circle 272 on the reader service coupon or contact Motorola Australia, 673 Boronia Road, Wantirna 3152; phone (03) 887 0711.

Fast 10-bit A/D converters

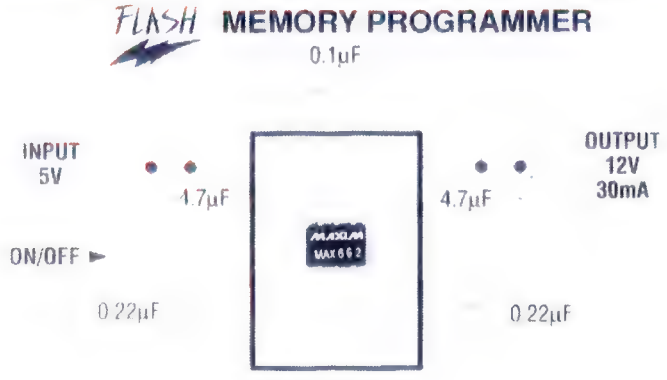
Using an innovative, multistep conversion technique, the National Semiconductor's 10-bit ADC10061, ADC10062, and ADC10064 CMOS analog-to-digital converters offer sub-microsecond conversion times, yet dissipate a maximum of only 235mW. The devices perform a 10-bit conversion in two lower resolution 'flashes', thus yielding a fast A/D without the cost, power dissipation, and other problems associated with true flash approaches. The ADC10061 is pin-compatible with the ADC1061 but much faster, thus providing a convenient upgrade path.

The analog input voltage to the ICs is tracked and held by an internal sampling circuit. Input signals at frequencies from DC to over 200kHz can therefore be digitised accurately, without the need for an external sample-and-hold circuit.

The ADC10062 and ADC10064 include a 'speed-up' pin. Connecting an external resistor between this pin and ground reduces the typical conversion time to as little as 350ns, with only a small increase in linearity error.

For ease of interface to microprocessors, all the capacitors have been designed to appear as a memory location or I/O port, without the need for external interface logic. They feature built-in track-and-hold, single +5V supply, 1,2, or 4-input multiplexer options, and require no external clock

For further information circle 273 on the reader service coupon or contact IRH Components, 1-5 Carter Street, Lidcombe 2141; phone (02) 364 1766.



Flash memory power supply

The MAX662 is a 12V, 30mA flash memory programming power supply. It provides the necessary +12V +/-5% output to program byte-wide flash memories, and needs no inductors to deliver a guaranteed 30mA output from inputs as low as 4.75V.

This step-up voltage converter is a very small and low cost programming solution and also eliminates inductors. The complete circuit fits into less than 0.2in² and requires only a few inexpensive tiny capacitors. A logic level programming control input interfaces directly with microprocessors. Quiescent current is 320uA when on, and only 70uA when off. A complete pre-assembled surface mount evaluation kit is available for the MAX 662.

For further information circle 271 on the reader service coupon or contact Veltek, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

New microcontrollers offer 3V or 40MHz

Siemens has announced the C500 series of 8-bit microcontrollers. The versions for 3V are of interest for handheld devices such as mobile telephones or measuring devices, while the 40MHz version gives fast reaction and regulation times in time-critical industrial applications.

They are compatible with the SAB8051 family and use the world's largest software and support market for microcontrollers: the fast SAB-C501 and the SAB-C503 with a high-precision analog/digital converter (ADC) 'on chip'.

The SAB-C501 is function, pin and op-code compatible with the SAB80C52. This 8-bit microcontroller has a clock frequency of 40MHz, but is also available in a version which operates at 12MHz.

There is both a ROM-less version and a version with an 'on chip' 8KB ROM, which allows the full frequency range to be used without the need to access fast external memory. There is also a 256-byte RAM on the chip, an interrupt system and

FLUKE

PHILIPS

Fluke and Philips handheld tools - so advanced they're simple to use

A host of user-friendly features

Many special features make the Fluke DMMs and Philips ScopeMeter more convenient and easier to use.

The display screens are easy to read. Touch Hold® on the Fluke 70 and 80 series freezes the display on stable readings - so you can use both hands to take a measurement.

The Fluke 10 series features a time saving V chek™ - a Fluke innovation.

All series feature auto and manual ranging. In short, these user-friendly tools make taking measurements a great deal easier for the on site technician.

The Fluke Multimeter Series

How much meter can you get into a multimeter?

The Fluke series of versatile multimeters blend state-of-the-art analogue and digital performance with affordability. Offering an impressive range of measurement capabilities for the price.

The Philips PM 3092 Series ScopeMeter

The perfect, all-round tool trouble shooting package.

The ScopeMeter is a rugged, high-performance 100 MHz digital storage oscilloscope and a full-featured 5000 count multimeter - in one, handheld instrument.

It's the ideal companion for on-the-go service and test.

THE UN-BREAKTHROUGH THAT WILL HAVE YOU SMILING FROM VOLTS TO OHMS

Fluke and Philips present the ScopeMeter. Plus a tough range of Digital Multimeters

DESIGNED WITH USER SAFETY IN MIND

User safety is a primary consideration

A safe investment

Ask someone who owns a Fluke and Philips meter. They'll tell you that even if you accidentally overload it or hook it up wrong, you can depend on it.

Fluke and Philips meters offer excellent overload protection.

Further safety features include recessed input jacks, non-inflammable cases, test leads with shrouded connectors and finger guards.

HOW TO BEAT THE HIGH COST OF CHEAP METERS

Ooops!

A tool isn't very useful if it won't withstand the hazards of everyday use.

By putting them through some of the toughest simulated accidents imaginable, Fluke and Philips meters are as tough as they are affordable.

Tough enough to work wherever you work, they offer a long battery life.

And to make sure your modest investment in a meter is well protected, Fluke and Philips build them to last - inside and out - with rugged, protective casings and error-proof design.

The result? A wide choice of tough, high performance diagnostic tools for the electrician on the go.

For further information please contact your local
Philips Test & Measurement Organisation:
NSW (02) 888 8222 **VIC** (03) 881 3666 **WA** (09) 277 4822
QLD (07) 240 3700 **SA** (08) 384 2888 **NZ** (09) 849 4160

You'll measure better performance

READER INFO NO. 13

PHILIPS

three 16-bit timers which serve as universal timebases. The SAB-C503 also has the 8-KB ROM and 256-byte RAM, as well as an ADC, which operates at a frequency of 18MHz. The integrated oscillator watchdog monitors the clock frequency and ensures a fast power-on-reset (typically 18us); the CPU is monitored by a programmable watchdog. The outstanding peripheral module is the high-precision 10-bit A/D converter with up to eight analog channels. With a conversion time of less than 10us, it is one of the fastest ADC 'on chip'.

For further information circle 274 on the reader service coupon or contact Siemens, 544 Church Street, Richmond 3121; phone (03) 420 7716.

Variable-gain 2.5GHz amplifiers

Hewlett-Packard has introduced two new silicon bipolar MMIC(1) variable-gain amplifiers, IVA-14228 and IVA-14208 which offer a combination of higher performance and lower price than previous versions.

These amplifiers are used in automatic gain control circuits as limiting stages in global positioning system (GPS) receivers, satellite communications receivers, unlicensed spread-spectrum, and other communications systems operating at up to 2.5GHz. In fibre-optic communications applications such as SONET, the amplifiers operate at data rates of up to 3.4Gbps.

An important feature of these amplifiers is that both input and output can be operated single-ended (with the signal referenced to ground potential) or differential (with a balanced signal line). It offers users maximum flexibility in applications. Additional features include: operating bandwidths from DC to 2.5 GHz or 3.4Gbps data rates; 24dB typical gain; 34dB typical control range (amplifier gain can be varied to produce 10dB attenuation); fast gain control response of less than 10ns, typical; and operation from 6V DC.

For further information circle 276 on the reader service coupon or contact VSI Promark Electronics, 16 Dickson Avenue, Artarmon 2064; phone (02) 439 4655.

4KB FRAMs

US company Ramtron International has announced the availability of its first serial ferroelectric random access memory (FRAM) product, the FM24C04. The 4KB FM24C04 is the newest member of the company's FRAM product family which also includes other 4KB to 64KB products.

The I²C bus compatible product is a pin-for-pin plug-in replacement for existing 24C04 EEPROM products, with a combination of no write delay, fast sequential writes, 100 million write cycle endurance, and low power.

Applications for the FM24C04 range from consumer electronic products including televisions, computer monitors, printers, and modems, as well as power meters, industrial controls and applications where nonvolatile data storage is necessary.

Organised as 512 x 8-bits, the FM24C04 is manufactured using 1.5 micro silicon gate CMOS technology with integrated ferroelectric storage cells. It operates from a single +5V power supply with 100uA maximum current and is TTL/CMOS compatible.

For further information contact the Communications Department, Ramtron International Corporation, 1850 Ramtron Drive, Colorado Springs, Colorada 80921; phone (719) 481 7000, fax (719) 488 9095. ❖

50MHz op-amp

Analog Devices' AD817 high speed, low power operational amplifier offers 50MHz unity-gain bandwidth, 350V/us slew rate and requires a maximum of 7.0mA supply current. In addition, the AD817 is fully specified for operation from single +5V or dual +5V or +/-15V supplies. It can sink or source up to 50mA output current, and is able to drive high capacitive loads while maintaining excellent signal integrity.

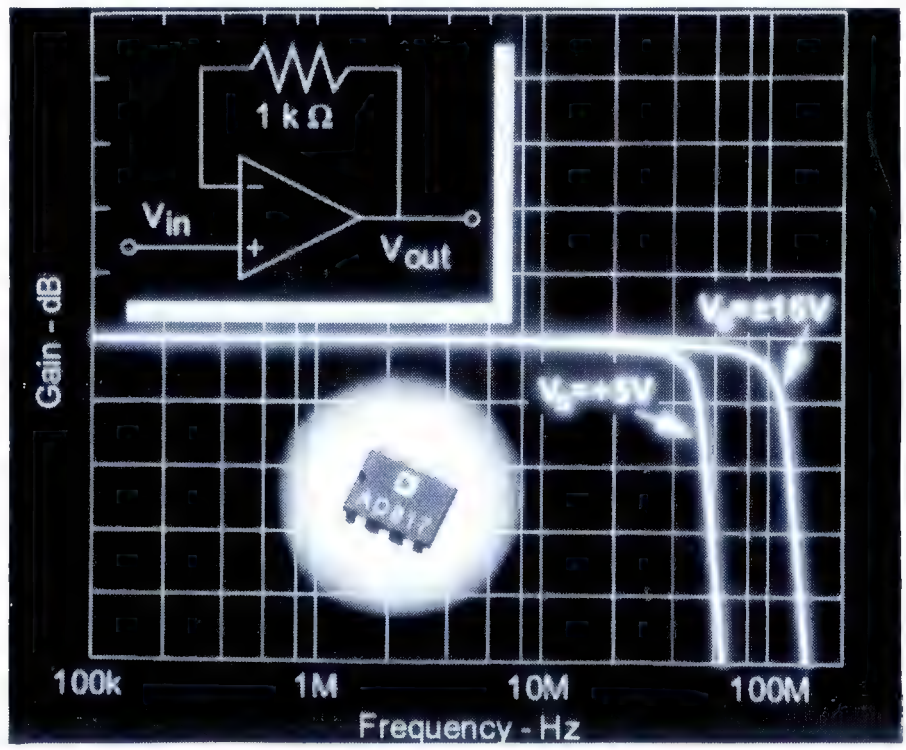
The AD817 is designed for high volume, high performance applications including video drivers and mixers, office automation equipment (fax machines and colour copiers) and liquid crystal displays.

Video specifications for the AD817 include: a gain flatness of 0.1dB, sustained to 70MHz (gain=+1); differential gain and phase errors of only 0.04% and 0.08% respectively; and a settling time of 45ns (to 0.1%), rising to only 70ns (0.01%). This high level of performance brings professional video specifications within the grasp of designers of high end consumer equipment.

With the ability to operate from a single +5V supply and consume low power, the AD817 is well suited to battery powered applications where AC performance is important.

In applications such as high speed analog-to-digital converter (ADC) buffering, the AD817 simplifies the design task because it is capable of driving high current into high capacitive loads. ADCs, particularly high speed flash and subranging converters, often present a varying capacitive load at the output — which is difficult to drive accurately.

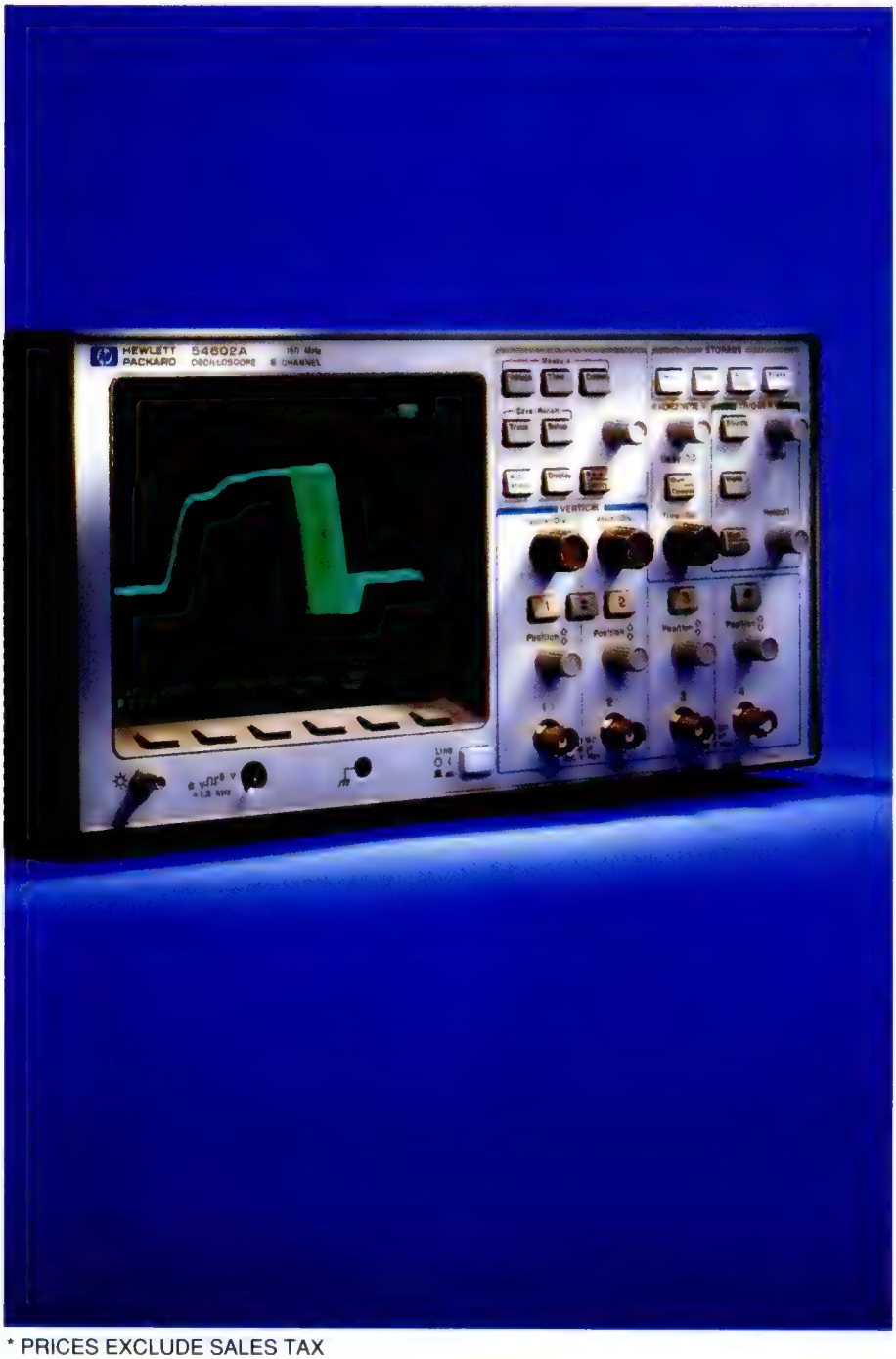
For further information circle 275 on the reader service coupon or contact NSD Australia, Locked Bag 9, Box Hill 3128; phone (03) 890 0970.



FFT and a scope for under $5,500

You Didn't Think You Could Afford HP, Did You?

Think Again.

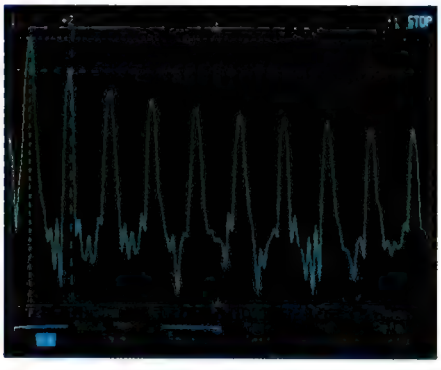


The value of this 100MHz scope is easy to see.

The HP54600 gives you superior viewing of virtually any waveform, even at low rep rates and slow sweep speeds. It looks and feels like an analog scope, with dedicated knobs and a display that responds instantly to your control changes. And it has the digital power that analog can't give you – high accuracy, automatic measurements, hard copy output and programmability.

But what really stands out is that all this performance costs just **$4,840** (4-channel) or **$4,170** (2-channel).* What's more, now through June 30, 1993, you can add FFT by purchasing an HP 54657A or 54658A Measurement/ Storage Module **for only $625.**

For more information call our customer information centre on 131347. We are happy to send you literature.



FFT is just one of the advanced waveform viewing tools you'll get with the HP54657A/58A Measurement Storage Module.

* PRICES EXCLUDE SALES TAX

HEWLETT PACKARD

Test Instruments Feature:

H-P's new 53131A Universal Counter

The latest addition to Hewlett-Packard's growing range of 'affordable' test instruments is the 53131A Universal Counter, which is due to be released here shortly. An 'intelligent' counter with extensive system measurement facilities, it offers two input channels with a range from DC to 225MHz as standard, plus an optional third channel with a range from 100MHz to 3GHz.

by JIM ROWE

Like most of the latest breed of test instruments, H-P's new 53131A Universal Counter is controlled by an internal microprocessor. This approach makes particular sense with a counter, because internal 'intelligence' allows the instrument designer to provide many measurement features and facilities that simply couldn't be done with conventional 'dumb' circuitry.

For example the counter can be arranged to make fast yet high resolution low frequency measurements, by making a measurement first of the input signal's *period*, and then calculating the reciprocal of this in order to display the frequency — all in little more than one or two signal cycles. Similarly with suitable triggering circuitry the counter can be arranged to calculate and display things like pulse width, duty cycle and rise and fall-times, while for a two-channel instrument the microprocessor can be arranged to calculate and display things like the relative phase shift and/or time difference between two signals.

As you might well expect, Hewlett-Packard has given the new HP 53131A all of these kinds of facilities and more. Apart from measuring the usual primary parameters like frequency, period and time interval, it can also measure frequency ratio, pulse width, rise/fall times, phase, duty cycle and peak input voltage (unusual for a counter). As if this weren't enough it can also perform *maths* functions on any of these measurements — deriving things like the average of a series of measurements, testing to see if a measurement falls within prescribed limits and so on.

Quite apart from these measurement capabilities, the counter's inbuilt micro is also used to allow storage and recall of up to 20 different measurement *setups*. This is very handy, as the counter has an almost bewildering range of manual setup adjustments in addition to its default 'automatic' settings. For example each input channel allows control of things like input coupling (AC/DC), input impedance (1M/50Ω), input attenuation (x1/x10), input filtering (100kHz LP filter in/out) and trigger level (auto or numerically adjustable), while there is also control of measurement mode, sample triggering source, display resolution (up to 10 digits), choice of internal or external timebase and so on.

Finally, the inbuilt micro is also used to provide the HP 53131A with its external control and communications capability. It's provided with both RS-232C serial and HPIB/GPIB/IEEE-488 parallel ports, and can either drive a printer or plotter directly via the RS-232C port, or communicate with a computer via the GPIB port.

The counter measures 213 x 89 x 348mm, and weighs 3.5kg. In its basic configuration it provides two input channels, each with a frequency range from DC to 225MHz, with an input sensitivity of better than 20mV RMS up to 100MHz and 30mV up to 225MHz. The standard timebase offers a temperature stability of better than 5 parts in 10^6 between 0° and 50°C.

The counter's display is of the green vacuum fluorescent type, and provides a full alphanumeric primary display with secondary mode and status indication. The main characters are about 10mm high, and very readable.

When the counter is controlled from the front panel in 'local' mode (as opposed to GPIB 'remote' mode), the display is used together with the front panel pushbuttons to allow selection of instrument functions and modes, using a hierarchical menu system. This is as well as displaying the measured parameter, of course...

Then when the counter is in 'remote' mode, the display is also used to indicate both instrument status and any GPIB error codes which may be generated.

By the way, a nice feature of the counter's power supply is that it automatically switches to suit the mains input voltage. It actually has two main mains voltage ranges, from 88 - 135 volts and 176 - 269 volts, and switches between the two when this is necessary. The power consumption is typically 30W (170VA maximum), and the counter has a specified operating temperature range of 0 - 55°C.

Not surprisingly, the basic HP 53131A counter can be enhanced in a number of ways, by means of options. One of these is a prescaler-type third input channel (option 030), which provides counting from 100MHz to 3GHz with a fixed input impedance of 50 ohms and a sensitivity of better than -27dBm (10mV) up to 2.7GHz, and -21dBm (20mV) up to 3GHz.

The other options are two different types of improved timebase, for greater measurement accuracy and stability. Option 001 is a medium stability oven oscillator giving an ambient temperature stability of better than two parts in 10^7 (i.e., about 20 times better than the standard timebase), while option 010 is a high stability oven oscillator giving a stability of better than seven parts in 10^9 — around 35 times better again. With both of these higher stability timebase options fitted the counter is able to perform electronic self-calibration.

The HP 53131A is also designed to accept an external timebase, as an alter-

native to the internal timebase when a very high accuracy frequency reference is available. The external timebase can be at 1MHz, 5MHz or 10MHz, with the counter automatically adjusting itself to whichever is applied. Its own internal 10MHz timebase signal is also made available at a rear panel connector.

Trying one out

Hewlett-Packard Australia had a pre-production sample of the HP 53131A counter here for a short time, and we were able to borrow it for a few days for a 'brief preview' evaluation. It was fitted with both the third 3GHz prescaler input channel and the '010' high stability oven timebase oscillator options, so we were able to try out virtually all of its capabilities.

Impressive they all turned out to be, too. The counter has an almost bewildering range of measurement modes and functions; far more than most. It certainly seems to justify H-P's labelling as a 'Universal Counter', and to more than qualify as an instrument just as suitable for system-level measurement as it is for standard independent benchtop use.

Despite its many capabilities, though, we didn't find it particularly difficult to drive. We were a little intimidated at first, but soon found that the front-panel controls and display menues had been designed for logical and intuitive operation. The instrument's default power-up configuration is for standard frequency measurement on channel 1, in any case, so you can measure a frequency without even touching any of the array of buttons, just by connecting it to this input!

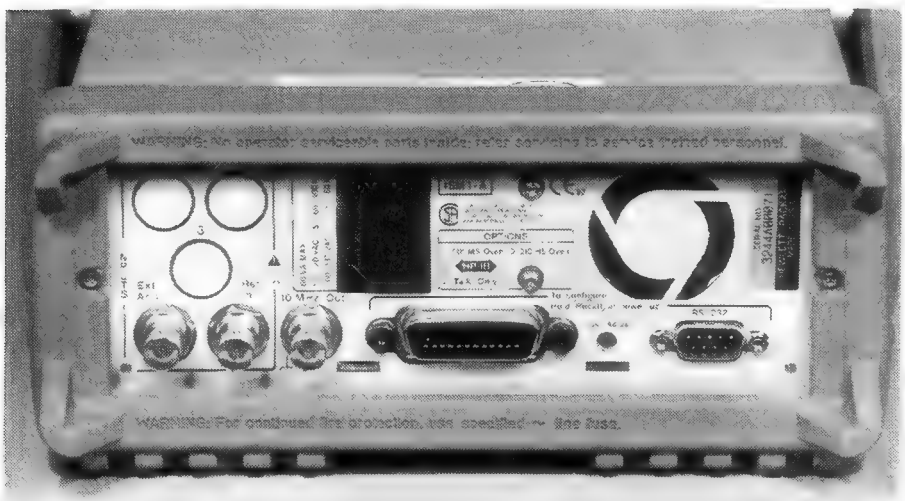
We don't have access at present to a frequency standard capable of testing the accuracy of the HP 53131A's high stability timebase (you'd really need a rubidium or caesium standard, or at least a reference derived from one via the TV networks, which we're working on), but checking the counter's 10MHz reference signal with the facilities we do have at present suggested that it was well within the rated specs. Similarly all its measurements we were able to try out compared very well with those of the best of our existing instruments. In short, then, its basic performance seemed to be everything you'd expect from H-P.

Encouraged by the relative ease of driving the counter from its front panel, we tried controlling it remotely via the GPIB bus. This was convenient in one way, because we had just received a sample of Binary Engineering's 'GPIB Smart Cable', at the time the counter was being put through its paces. However we knew talking to the HP 53131A from the computer wasn't going to be as easy as from the front panel, because (a) at this stage, we're still very much at the 'tyro' level when it comes to GPIB instrument programming; and (b) the Programming Manual for the HP 53131A is about 10mm thick, showing that there's a fair bit involved...

As it turned out, in the limited time available we weren't able to get much further than simple system-level mode switching and status reporting. However it was enough to show us that if we *were* more proficient in GPIB programming, the counter would probably be relatively easy to drive this way, as well as from the front panel.

Overall, then, we found the HP 53131A a very well designed and high performance instrument, as well as one that offers far more measurment facilities than virtually any other counter we've tested to date. For the quoted basic price of $2806, it therefore seems good value for money. The '001' medium stability oven timebase option costs an extra $1006; the '010' high stability option costs $1507; and the '030' 3GHz input channel costs $1341. All of these prices are plus sales tax if applicable.

Further information is available from Hewlett-Packard Australia's Customer Information Centre, by calling 131 347 (a 25-cent call from anywhere in Australia). ❖



As you can see from this rear view, the HP 53131A is fitted with both RS-232 serial and HPIB parallel communications interfaces. Also provided on the back panel are a 10MHz timebase output and an input for an optional external timebase.

Special Feature:

The latest in Test & Measurement Instruments

Programmable power supplies

Philips Test & Measurement has added two new models to its PM2800 Series of compact Programmable Power Supplies. The new units have a choice of single or dual 8V/15A outputs, for power ratings of 120W or 240W.

The supplies have a built-in IEEE-488 interface and are intended for use in automated test setups, for example, for testing analog and digital boards, as well as a wide range of other electronic and electrical products demanding remote control of power delivery.

All functions are accessible via the IEEE-488 interface, as well as by using the local front-panel controls. Built-in support for the SCPI (Standard Commands for Programmable Instruments) protocol simplifies the generation and maintenance of application programs.

SCPI provides a common command set across a wide range of test and measure-

ment instruments. Outputs are programmable for either constant voltage (CV) or constant current (CC) operation. The modules act as CV or CC power supplies, depending largely on load conditions. The polarity of the current can be either positive or negative.

All power supplies can both source and sink current. A typical application for current source and sink is a battery test, in which the supply is used to both charge and discharge the battery. In this way, the behaviour of batteries and battery-powered electronics can be tested under precisely controlled power conditions. Also, in some manufacturing applications the current sink capability is used quickly to discharge circuit boards, enabling a faster exchange of boards after the tests have been passed.

For further information circle 201 on the reader service coupon or contact Philips T&M, 34 Waterloo Road, North Ryde 2113; phone (02) 888 8222.

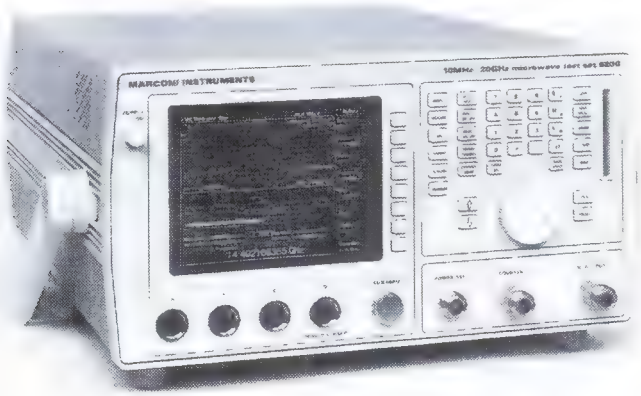
Four channel oscilloscopes

Tektronix Australia has announced the addition of two new four channel models to its recently announced TAS (Tektronix Analog Scope) 400 family of analog real-time oscilloscopes. The new 100MHz TAS 475 and 200MHz 485 scopes provide greater capabilities for tougher service applications.

The new four channel models offer a full range of amplification and attenuation. Both are ideal for tough service ap-

Microwave test set

Marconi Instruments' new 6200 series Microwave Test Set (MTS) is a portable, integrated microwave measurement system incorporating a fully synthesised sweeper, a four channel scalar analyser with high resolution colour display, a power meter and frequency counter.



The 6200 includes many innovations such as the sweep generator which is believed to be the fastest fully synthesised sweeper in the world, allowing real-time measurements of microwave devices.

It also offers an advanced frequency domain reflectometry (fault location) technique for accurately locating discontinuities in microwave transmission lines at near real time. The 6200 has been very well received in Australia with over $500,000 worth of significant orders from Telecom, OTC, and the Royal Australian Navy, for example.

The low cost 8GHz version has proved to be very attractive in the cellular telephone industry where it is being used extensively for the sweeping of antenna feeders at base stations and cell sites, both for installation and maintenance.

For further information circle 205 on the reader service coupon or contact Marconi Instruments, Unit 1/38 South Street, Rydalmere 2116; phone (02) 638 0800, fax (02) 638 3131.

plications where multiple channels need to be displayed to troubleshoot circuit conditions — such as three phase power or logic circuitry.

Tailored to the analog scope user, the TAS 400 scopes are based on the popular TDS (Tektronix Digital Scopes) family's user-friendly, streamlined interface, making operation virtually intuitive. A proprietary hybrid device houses the entire acquisition system for each input channel, reducing the parts count by 75%. It also improves the meantime to calibrate by 50% and cuts the manual adjustments to under 14.

Tektronix backs all of its TAS 400 scopes with a free warranty. If the TAS fails within a three year period, the company will replace it with a free scope.

For further information circle 206 on the reader service coupon or contact Tektronix Australia, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066, fax 888 0125.

Autoelectronic diagnostics

The MX63 Autometrix from ITT Instruments is described as the latest in automotive test gear, and is supplied as a comprehensive kit with the necessary tools for all general and most dedicated diagnostic tests. Many of its functions are normally reserved for much larger instruments.

The handheld MX63 is designed for the tough environment found in the workshop. It comes supplied in a sturdy briefcase, complete with rubber shock absorbing case, and inductive tachometer probe, silicone test leads and an application manual detailing extensive automotive tests.

The specific checks described in the application guide are: state of charge and battery voltage (and voltage drop during starting); checking the ignition condenser and alternator rectifier diodes; measuring the starter motor current, engine speed in RPM, dwell measurement in percent, cam angle in degrees; and measuring the duty cycle, voltage and output of the λ probe (0_2 richness).

It is also possible to use the MX63 to measure the injection time of a diesel engine, the vehicle alarm delay time and the ABS sensor frequency output. The unit can also give a indication of the carburettor butterfly valve position with the aid of the bargraph.

Additional features include: automatic range selection, with manual override; recording of MIN and MAX values; average function AVG to smooth out noisy signals; rapid PEAK HOLD mode to capture the peak value; and a relative mode REL to show the variation of a signal from a preset value.

For further information circle 207 on the reader service coupon or contact Elmeasco Instruments, PO Box 274, Salisbury 4107; phone (07) 875 1444, fax (07) 277 3753.

LAN cable tester

Datacom Technologies has released its LANcat 1800 LAN Cable & Activity Tester. Based on the earlier LANcat 1500, the LANcat 1800 features the ability to perform TDR, NEXT (near-end cross talk) and attenuation measurements to 20MHz, making the instrument ideal for testing of token-ring cable installations.

Other improvements include automatic certification of LAN wiring as per IEEE-802.5; storage of up to 500 cable test results; shielded twisted pair (IBM Type 1) testing; oscilloscope mode to assist TDR tracing; and NEXT and attenuation measured to -46dB.

For further information circle 240 on the reader information coupon or contact Elmeasco Instruments, PO Box 30, Concord 2137; phone (02) 736 2888, fax 736 3005.

Cable and harness tester

The Model ST128D cable tester from Binary Engineering is a low cost solution to the repetitive testing of cable assemblies and wiring harnesses. 128 points are provided as standard, with expansion up to 256 test points available.

The ST128D cable tester is portable and very simple to use. It has inbuilt automatic program generation, which simply requires a known correct sample to be available in order to start testing a batch of cables or harnesses. The speed of operation means that cables can be tested as fast as they can be plugged in.

All opens and shorts are reported in detail on a back-lit front LCD screen, with results also being available via a printer port.

Pass/fail insulation resistance thresholds can be set between 100k and 5M, and short circuits are defined as less than 1k. The test voltage is set to 5V DC. Switching is by solid state CMOS devices, all of which are mounted in sockets for easy servicing. Power usage is a low 8W, and the tester is fitted with a universal power supply for ease of operation.

For further information circle 202 on the reader service coupon or contact Binary Engineering International, 102/658 Pittwater Road, Brookvale 2100; phone (02) 938 5344, fax 938 5875.

Thermal array oscillograph

The Yokogawa OR2300 Thermal Array Oscillographic Recorder is a new generation of thermal array recorders with a performance comparable with that of high speed UV recorders. In real time the maximum speed is 500mm/s, and in memory mode the effective speed is equivalent to 40m/s.

With eight differential input channels, the OR2300 can accept voltages to 30V RMS. It features a 127mm screen, which can display waveforms in either real time, or in memory, before they are printed. This enables the operator to adjust the signals for best position and amplitude to minimise paper waste.

Channel sensitivity is +/-50mV to 50V full scale with a frequency bandwidth of 40kHz. Each channel can be separately annotated with up to 120 characters, and a total of five lines of text, each with 136 characters, can be added to the end of a particular recording. Data logging is also available at intervals of one to 60 seconds along with date and time stamping, time ticks and the provision of two event markers. Usable chart width is 320mm and channel identifying markers are printed at regular intervals.

Memory cards with a capacity up to 1MB are available and can store both data and setups.

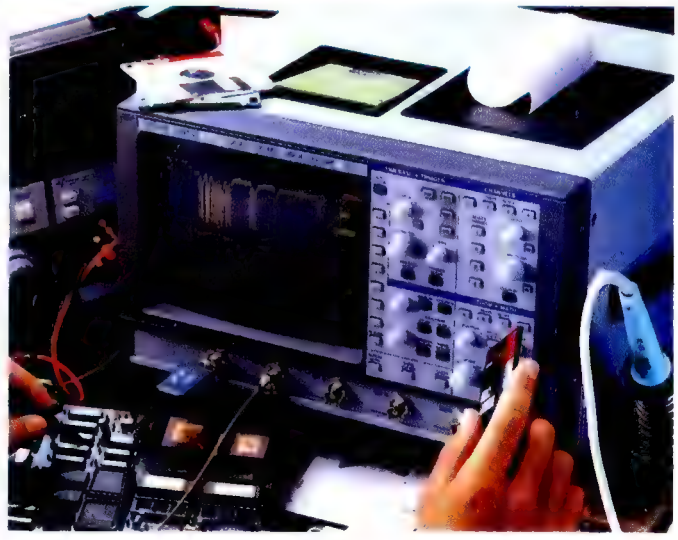
This information can in turn be shown on the display prior to printing. The

Test & Measurement

OR2300 has a memory length of 512K per channel, which can be divided into one, two, four, eight or 16 blocks, one for each trigger event.

It is also possible to store in memory information being displayed in real time. In addition all information in memory can be displayed on the screen prior to printing. An extensive range of triggering functions is provided, both internal and external, to cover just about every measurement contingency.

For further information circle 239 on the reader service coupon or contact Tech-Rentals, PO Box 621, Ringwood 3134; phone (03) 879 2266, fax 879 4310.



'Built-ins' for DSOs

LeCroy has announced new capabilities for its 9300 series Digital Storage Oscilloscopes: a built-in 1.44MB Floppy Disk Drive, and a built-in high resolution printer. Both options may be added or retrofitted to any of LeCroy's 9300 series oscilloscopes.

The 3.5" floppy disk drive is DOS compatible, and stores instrument setups and acquired waveforms. Since the setups may include extensive Pass/Fail tests, the floppy can store libraries of such tests. These may be shared with other scope users, to ensure that all important tests are made in the same way, and with the same limits. In the same way, the floppy may be used to store Passing or Failing waveforms.

It may also store reference ('golden') waveforms or waveform masks. Since it's DOS compatible, it is also a convenient way of transferring data to a PC. Screendumps may be saved to the floppy as TIF-format graphics files. These files can be read directly by word processors and desktop publishing packages. The floppy drive complements LeCroy's existing memory-card based storage, which is also DOS compatible. Both are ideal for ATE applications, where test data must be stored locally. They are especially valuable for field service applications, or laboratory setups where data must be stored rapidly for later analysis.

The built-in graphics printer provides high resolution screendumps in under 10 seconds. It is the perfect tool for service or maintenance engineers, or those requiring fast signal documentation in the laboratory.

For further information circle 205 on the reader service coupon or contact Scientific Devices Australia, 2 Jacks Road, South Oakleigh 3167; phone (03) 579 3622, fax 579 0971. ❖

Test Instruments Feature:

Binary's GPIB Smart Cable

Local T&M specialist Binary Engineering has developed an innovative 'Smart Cable' package which allows virtually any standard personal computer to be linked to test instruments using the GPIB/IEEE-4888 control interface. Fully designed and manufactured in Australia, the package consists of an adaptor/cable which simply plugs into any standard Centronics printer port, plus matching user-friendly driver software. It must be the easiest and lowest-cost way yet developed, to provide a PC with full GPIB control facilities...

by JIM ROWE

An increasing number of test instruments are being fitted with GPIB/IEEE-488 communications bus interfaces, so they can be linked to a computer and controlled remotely by it. This allows a collection of instruments to be controlled together for automated testing — great for complex R&D work, as well as production test situations.

Incidentally if you're not yet familiar with it, the GPIB/IEEE-488 bus is a reasonably standardised one for remote control of, and communication between test instruments. Developed from the 'HPIB' bus originally designed by Hewlett-Packard for its own instruments, it has been expanded and enhanced by the American IEEE and others, and is now used by many instrument manufacturers. The basic bus is a fairly fast bidirectional one using eight-bit parallel data, plus a further eight lines used for 'handshaking'. The standard connectors used have a total of 24 pins and are similar to the 36-way Amphenol connectors used on parallel printers, but with a pair of screws used for securing the connector.

Of course in order to use your computer to 'talk' to an instrument via the GPIB bus, the computer itself needs to be provided with the matching I/O port. Needless to say suitable cards are available, especially for IBM-compatible computers, but because they aren't used in the same volumes as other PC cards, they tend to be fairly expensive — typically around $750 or so, once you include the matching driver software and GPIB connection cable.

So until now, using your PC for GPIB control of even a single instrument has been fairly expensive. But happily this has all changed, with the release of a new product called the GPIB Smart Cable.

Designed by talented local engineer Tony Richardson and made in Australia by Binary Engineering International (BEI), which is also marketing it, the GPIB Smart Cable consists of two main items. There's an integrated adaptor/cable hardware assembly which simply plugs into a standard Centronics parallel printer port, and a matching set of software.

Together, this hardware-plus-software package provides virtually everything needed to control GPIB instruments from a standard PC. In fact literally *nothing* else is needed to control a single GPIB instrument, apart from the PC and instrument themselves. Additional GPIB cables are only needed when you want to control further instruments (which connect to the common GPIB bus in parallel, using either a 'daisy chain' or 'star'scheme).

There are actually *three* different models of the Smart Cable, with the lowest cost GSC-10 model only capable of controlling a single GPIB instrument. Then there's the mid-priced GSC-11, capable of controlling up to three instruments, and finally the GSC-12 which can itself control as many as 31 instruments — although in practice the number of instruments connected to a single GSC-12 may be limited to 15, because of hardware driving limitations in the *instrument* interfaces. And all that's needed to communicate with additional instruments, in the case of the GSC-11 and GSC-12, are standard GPIB connection cables (which BEI can also supply).

All three models are externally identical, with the adaptor section housed in a sturdy mild steel 'enlarged backshell' case measuring only 101 x 55 x 15mm overall (including DB-25 plug) and weighing a modest 380g. Power for the interface comes from the PC's printer port itself, and the integrated GPIB cable is 1m long for all models.

One big advantage of having the computer's GPIB interface built right into the Smart Cable is that unlike internal adaptor cards, it can be hooked up very quickly and easily to a variety of computers. You aren't forced either to dedicate a particular computer as the GPIB controller, or to keep on having to open up machines to instal and/or remove cards. In fact you can even use a *laptop* PC as a GPIB controller — something that until now hasn't really been possible.

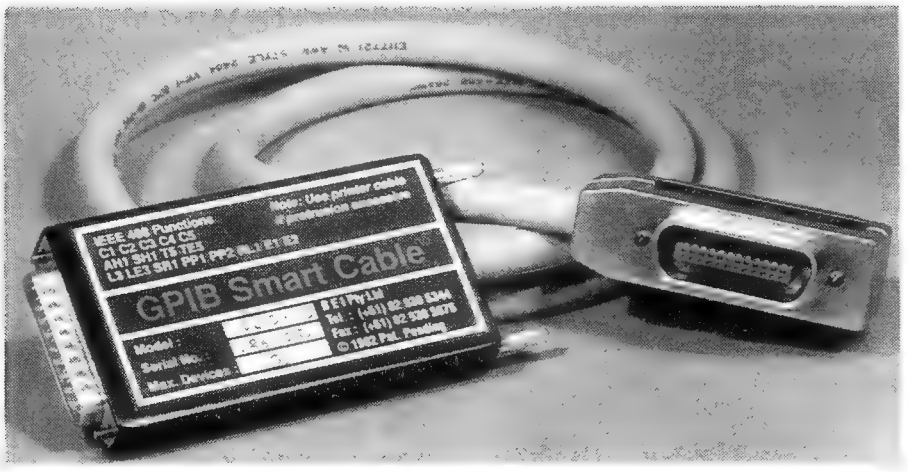
But the other big advantage of the Smart Cable approach is its *low cost*. The base model GSC-10 package sells for only $375 plus tax, making it by far the cheapest way yet to provide a PC with everything needed for GPIB control of a single instrument. The three-instrument GSC-11 version costs only $100 more, while the full-capability GSC-12 still only costs $575 plus tax — well below the cost of any current alternative packages.

For connecting additional instruments up to the GSC-11 and GSC -12, standard GPIB extension cables (two metres long) are also available from BEI, for only $60 each plus tax.

Friendly software

One of the things that has tended to make life difficult for people using GPIB is that although the hardware side of the bus is quite firmly standardised, the software side has been somewhat less so. A set of general purpose 'Common Commands' have been defined in the IEEE 488.2 standard, with system-level commands applying to virtually any kind of instrument, and these have become fairly widely used. But these basically don't cover the 'nitty gritty' of setting up a particular instrument's functional configuration, and making actual measurements. As a result, many instrument manufacturers have 'done their own thing' in this area, and the result has been very confusing for users.

In the last couple of years Hewlett-Packard and others have developed a language called 'SCPI', standing for



Standard Commands for Programmable Instruments, and a consortium has been formed in the USA to promote its use. Many of the larger makers of GPIB instruments seem to be adopting SCPI, but even so it's still often necessary for users to wade through large programming manuals in order to work out how to program particular GPIB instruments — especially the more complex ones.

What this all tends to mean is that the software side of GPIB programming is still rather hairy. There's no really universal GPIB programming language at this stage, so firms like Binary Engineering can't simply provide a suitable interpreter/compiler package which will make talking to any instrument a 'snap'.

But Tony Richardson certainly seems to have done the next best thing. What he's written for the Smart Cable is a small suite of software programs which handle all of the basic low-level GPIB housekeeping, and make it as easy as possible for the user to communicate with each instrument in its own dialect.

There's a program called *GPTEST.EXE*, for example, which you run to test the Smart Cable adaptor itself and make sure it's correctly connected to, and communicating with, your PC. Then there's a program called *GPIO.EXE*, which can itself handle most of the basic commands needed to communicate with a typical GPIB instrument.

Written in Microsoft's *Visual Basic* and then compiled for speedy execution, *GPIO.EXE* makes it very easy to do things like initialise the Smart Cable adaptor and its software driver; set things up to communicate with a particular instrument (by selecting it from a menu, and hence defining its GPIB bus address and basic handshaking protocol for *GPIO.EXE*); toggle the instrument between its 'local' and 'remote' modes of operation; reset the instrument to its default setup; send a string of data (e.g., a command) to it, from either the keyboard or a disk file; read a string back from the instrument, and either display it on the screen (in either ASCII or hex), or save it to a disk file; read the 'serial poll byte' from the instrument; send a 'group execute trigger' (GET) message to it; or display the logic status of all data and handshaking lines on the GPIB bus itself. In short, it provides most of the GPIB communications capability than many users are likely to need, especially when they're talking to only one or two instruments at a time.

But those who need a more extensive repertoire of GPIB command functions haven't been forgotten, either. In addition to *GPIO.EXE*, Smart Cable comes with two different 'environment extension library' files, which can be used to graft on a more complete set of GPIB commands to popular programming languages like Microsoft's *Visual Basic*, *Quick Basic 4.5*, *C* or *Pascal*. The file GPSMART.QLB is used to extend *Visual Basic* and *Quick Basic*, while GPSMART.LIB performs the same role for the other extensible languages.

The final software item that comes with Smart Cable is GPSMART.CNF, which is used to store the GPIB instrument configuration data used by both *GPIO.EXE* and the language extension library files. This file comes complete with sample configuration data for a small range of instruments, and is in plain ASCII format so that similar data for any of the user's own GPIB instruments can be added easily using a standard text editor (like the *EDIT* which comes with MSDOS V5.0).

Of course all of this is explained in GPIB Smart Cable's user manual, which comes in an A5 ring binder.

Trying it out

Binary Engineering very kindly loaned us a sample GPIB Smart Cable, and we were able to try it out for ourselves. We installed it on a 'workhorse' 286/12MHz machine, and tried it out on a couple of different GPIB instruments we had access to at the time: a Yokogawa DL 1200 digital sampling scope, and an advance sample of the new Hewlett-Packard HP 53131A/132A Counter. We only had access to the H-P counter very briefly, though, and were only able to spend a small amount of time exploring its extensive GPIB capabilities.

Installing the Smart Cable hardware and software turned out to be both fast and straightforward, and GPTEXT.EXE soon confirmed that everything was functioning correctly. It was then simply a matter of hooking up one or other of the GPIB instruments, and firing up either *GPIO.EXE* or say *Quick Basic 4.5* with GPSMART.QLB.

This turned out to be also fairly straightforward, although you do need to refer to each instrument and its manuals (a) to provide GPSMART.CNF with its correct GPIB address and protocol, and (b) to find out its particular set of 'fine detail' GPIB programming commands.

Luckily the configuration data for the Yokogawa DSO was already present in GPSMART.CNF, which made things easier with this instrument. Then it was simply a matter of turning to the DL 1200 manual and working through some of its commands and functions.

It didn't take too long to determine the basic configuration data for the H-P counter and add this to the file, so we could soon establish basic communication with it too and perform the basic IEEE 'Common Command' functions. But things then became somewhat bogged down, largely as a result of the H-P counter's fairly complex functions (its programming manual alone is about 10mm thick!) and our own modest familiarity at this stage with GPIB programming in general. To be honest, we didn't get too far before the counter had to be sent back — but we saw enough to realise that it was purely a 'learning curve' problem.

In short, then, our hands-on trial of the GPIB Smart Cable showed that as well as providing a very low cost way to provide almost any PC with GPIB control facilities, it's also surprisingly easy to instal and use. Congratulations to Tony Richardson and Binary Engineering for coming up with an excellent all-Australian product, and one that really deserves to succeed.

If you want to get into GPIB, then the Smart Cable is warmly recommended.

Further information on the GPIB Smart Cable is available from Binary Engineering International, Suite 102, 658 Pittwater Road, Brookvale 2100; phone (02) 938 5344, or fax (02) 938 5875. ❖

NEW PRODUCTS

Compact marine GPS receiver

Garmin International has released for the marine market, a new, powerful and ultra-compact fixed-mount GPS Receiver with pictorial graphic capabilities. With the push of a button, the GPS 65 can navigate out of tight spots while taking up minimal space on the dash, helm station or electronics box.

The large, bright dot matrix LCD displays easy-to-read presentations of all navigation information, quickly and easily guiding the user through the full spectrum of functions. Identification and selection of waypoints can be accomplished with ease. Additionally, the crosstrack deviation indicator (CID) allows the navigator to keep on course and

visually see where the boat is being steered. The GPS 65 continuously tracks and uses up to eight satellites for fast positioning and accuracy. It stores 250 waypoints and 10 reversible routes of 20 waypoints each.

Its mounting system accommodates flush, overhead or tabletop mounting. The new unit can be customised by the user for personal use, with CDI setups, alarms, specialised audio and display setup, date/time formats and interface options. Additionally, it provides the user with times of sunrise and sunset, as well as trip and fuel planning capabilities.

For further information circle 250 on the reader service coupon or contact GME Electrophone, PO Box 296, Gladesville 2111; phone (02) 816 4755, fax 816 2198.

PCBs, panels via laser printer

Queensland firm Palmtech is now able to supply sheets of a new Toner Transfer System or 'TTS' material, developed in the USA, which allows anyone with a laser printer to produce their own high quality printed circuit boards and dress panels. The material can also be used with many of the better photocopiers.

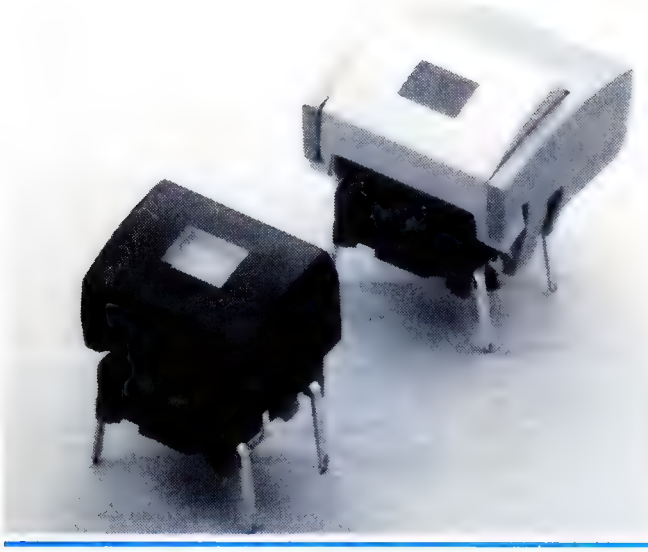
The TTS material is a specially formulated and coated paper, which allows a toner image initially printed and fused to its surface to be cleanly transferred off again onto another surface, by a second fusing operation. After the second fusing the paper can be removed from the image and new surface very easily, by soaking in water.

For making a PCB, the board pattern is first printed out in mirror image form onto the TTS material, in a standard laser printer or using a photocopier. Then the material is placed image down on the blank PCB laminate, and heat applied using a domestic iron set for 'cotton' (i.e., about 300°F). This re-melts the toner image, attaching it to the PCB copper.

Immersion in water for around one minute causes the bond between base TTS material and image to release, and the TTS material can be removed. The board can then be etched in the usual way, as the toner image acts as an etch resist.

Dress panels can be made in a similar way, with the final toner image protected from wear using coats of clear lacquer.

TTS material is available from Palmtech in packs of five sheets, for around $25. The company has sent us a sample for evaluation, and we will publish our findings when we have had the opportunity to try it out.



Illuminated pushbuttons

New 1C and 1H illuminated cap options have just been added to the Multimec switch line. Both caps are rectangular in shape with ergonomically curved front surfaces. Red, yellow and green LEDs provide bright illumination through the centrally located rectangular lens.

The 1C and 1H caps are available in a variety of seven distinctive colours and the 1C cap is complimented by the 2A bezel available in seven colours. The caps are modular in design and are easily snapped together by the customer.

Switch modules are sealed to IP-67 specifications and provide a compact illuminated switch package. Switches are rated at 50mA, @24V DC and have a minimum life rating of 10 million cycles.

For further information circle 241 on the reader service coupon or contact Erni Australia, PO Box 62, Mitcham 3132; phone (03) 874 8566, fax (03) 874 3160.

In the meantime, further information is available by circling 263 on the reader service coupon or contacting Palmtech, cnr Moonah and Wills Streets, Boulia 4829; phone (077) 46 3109, fax (077) 46 3198.

Doppler X-band transceiver

The DRO2982 (dielectric resonator oscillator) Doppler Module is an X-band microwave transceiver that uses the Doppler shift phenomenon to 'sense' motion.

The resonators are suitable for intrusion alarms, automatic door openers, speed measurement, collision avoidance and traffic control.

The basic principle of operation consists of detecting the difference (or frequency shift) between the transmitted (or LO) signal and the reflected return signal. The 'difference' of IF voltage signal, generated at the balanced pair of Schottky mixer diodes, occurs when motion is sensed. The IF can be amplified and processed to trigger an audible or visual alarm. The module employs low cost hybrid IC manufacturing techniques, which are rugged and reliable in other similar assemblies. The circuit features a FET oscillator with dielectric resonator tuning.

The dielectric resonator module affords frequency stable operation over a broad temperature range in either CW or a low duty cycle pulse mode. The 2982 type unit offers two separate microstrip

Arbitrary signal generator

The Tektronix 2000 Series combines powerful functionality not traditionally associated with arbitrary signal generators (ARBs) — an integrated controller, graphical user interface (GUI), waveform generation software and mass storage — with advanced signal-producing hardware in a compact unit suitable for benchtop use.

Two new models are now available. Both the Tektronix AWG2020 Arbitrary Waveform Generator and the AFG2020 Arbitrary Function Generator feature a 250MS/s sample rate and 12-bit vertical resolution. The AWG2020 converts digital information into analog waveforms and stores them in memory. The APG2020 offers similar functionality, plus sweep generation, extensive modulation capabilities and user-defined arbitrary waveforms. A new direct digital synthesis (DDS) technology used in the APG2020 provides excellent 1ppm frequency accuracy and allows 'agile' frequency changes at better than 4ns.

The two new signal sources are suitable for use in any application that requires emulation of a complex waveform output signal. The AWG2020 is especially useful for magnetic media testing in such devices as hard disk drives, floppy disk drives and tape drives. The AFG2020 provides communications signal emulation for testing modems and fax products. Both products will be used in a variety of telecommunications testing such as IR imaging test, TV broadcast, radar, sonar and lidar. In addition, they will find use in a variety of biomedical equipment testing applications, process control system diagnostics and testing of motor control systems.

For further information circle 264 on the reader service coupon or contact Tektronix, 80 Waterloo Road, North Ryde 2113; phone (02) 888 7066, fax 888 0215.

NEW PRODUCTS

patch antenna arrays for respective transmit and receive functions.

For further information circle 243 on the reader service coupon or contact Electronic Development Sales, PO Box 822, Lane Cove 2066; phone (02) 418 6999, fax 418 6550.

Video education

'UCANDO' offers a series of computer-animated training videos for electronics and digital/computer students. The company has recently added six more tapes to the original six which covered basic electronics, to take the student from digital/binary counting up to the complete operation of the computer central processing unit.

By the time that the student has completed these 12 videos, they should have a good basic knowledge of electronics, and a good education in computer hardware theory. The tapes are produced in the USA, and converted to PAL by UCANDO in NZ. Worldwide distributors are wanted for the VHS/PAL version.

For further information circle 249 on the reader service coupon or contact UCANDO, VCR Educational Products, PO Box 4603, Christchurch 8015 NZ; phone and fax 64-3-3795-570.

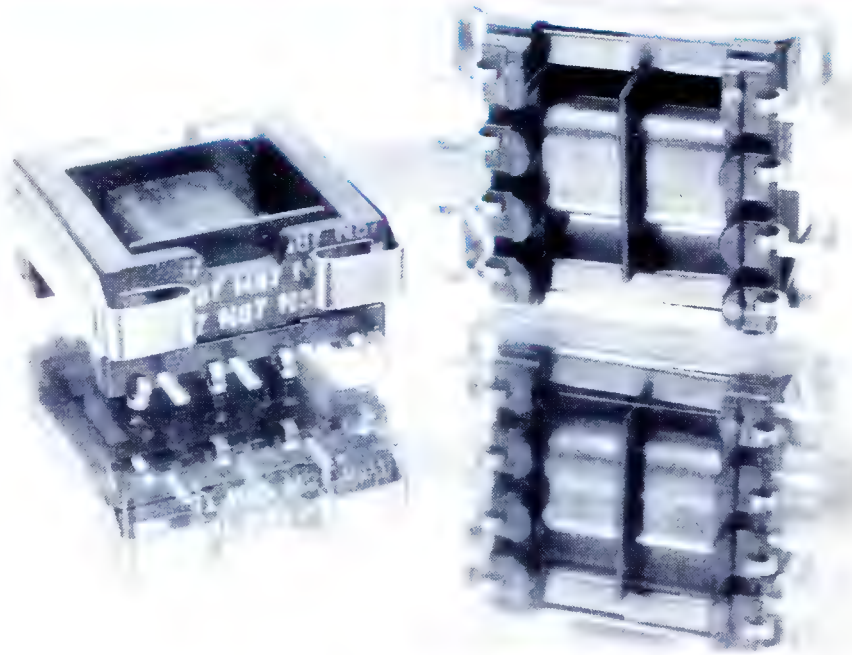
Gas irons now from Cooper

As a result of the merging of two well known and respected brands, the Weller Portasol range of gas soldering tools is now marketed in Australia and New Zealand by Cooper Tools Australia. The range represents a comprehensive array of attractively packaged and well presented portable, cordless, refillable butane gas powered soldering tools and accessories.

For further information circle 248 on the reader service coupon or contact Cooper Tools, PO Box 366, Albury 2640; phone (060) 21 5511, fax 21 7403.

EMI-RFI shielding

Zipmesh adhesive shielding is a reliable Faraday shield which solves many intererence problems by reducing the effects of EMI-RFI. Zipmesh is a tin-plated copper woven mesh tape with a self-ad-



Low profile ferrite cores

Siemens Matsushita has developed a range of exceptionally flat EFD cores only 8mm high, with a power range of 40W. The new components are intended for the power transformers used in DC/DC converters.

EFD cores are ideal for SMD-type power transformers, which need as much space as possible for the windings. Since the design trend in DC/DC converters is towards even flatter units, the EFD 15 core form is a welcome achievement. The coil formers have J leads with wrapping tags. Typical applications for these ferrite cores are switched-mode power supply units for telecommunications systems and personal computers.

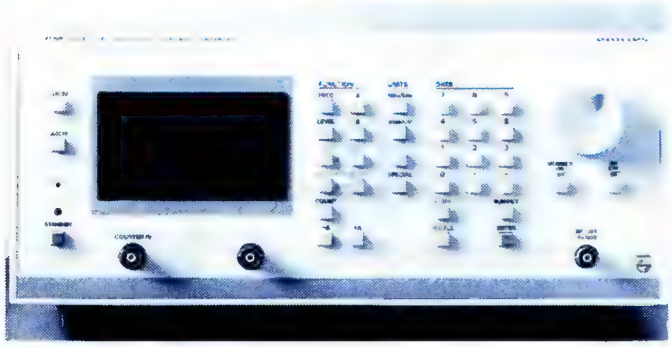
For further information circle 242 on the reader service coupon or contact Siemens Electronic Components, 544 Church Street, Richmond 3121; phone (03) 420 7710.

BUY TWELVE ISSUES, GET SIX FREE

That's right! If you subscribe to Electronics Australia right now, we will give you 18 issues for the price of 12. So all you have to do is send in $47 to us and we'll send you a copy of Electronics Australia for the next 18 months. That's a saving of 40% off the regular price. So don't miss out on this great offer - subscribe today and save $69.

How to order: Simply phone our toll free number 008 800 933 and have your credit card details ready. If you do not have a credit card then fill out the coupon attached and post. If the coupon is missing, send your name, address, phone number and cheque to Federal Publishing Company, Reply Paid No. 3, PO Box 199, Alexandria NSW 2015. Any enquiries can be made by phoning (02) 353 6666. Unsigned orders cannot be accepted.

HURRY OFFER ENDS 20rd JUNE 1993



RF signal generator

The new PM5330 radio test generator from Philips Test & Measurement offers a convenient, integrated solution to a wide range of testing requirements at frequencies from 100kHz up to 180MHz.

With its extensive choice of modulation and sweep facilities, together with programmable AM and FM modulation, variable output levels and optional RDS/ARI functions and FM stereo modulation, this generator covers numerous requirements in the testing, alignment and troubleshooting of RF components, radio receivers, consumer audio sets and communications and paging equipment.

A special feature of the PM5330 is its optional facilities for the testing of high end consumer radio equipment incorporating RDS (Radio Data System) and ARI (Automotive Radio Information) functions. The factory fitted RDS/ARI module provides integrated test, maintenance and quality control facilities for radio tuners and receivers. Up to 20 RDS messages are selectable at the front panel or by remote control. Ten of these RDS messages are predefined, and ten other messages are freely programmable.

An FM stereo option provides both stereo multiplex and RF modulated signals. In the FM stereo mode both internal and external modulation can be applied over a 20Hz to 15kHz frequency range, with selectable 0, 50us or 75us pre-emphasis and a choice of stereo and left or right channel only signals.

The PM 5330's modulation facilities include standard AM, FM and sweep, with optional FM stereo and RDS-ARI functions. Both internal AM and FM modulation are programmable between 20Hz and 20kHz, or can be applied from external sources. The sweep function is ideal for checking filters, and offers 10 calibrated sweep widths from 10kHz to 10MHz, with a clear indication of the centre frequency by a dot marker on the display. The lower sweep width of 10kHz and slow sweep speeds are ideal for narrow bandpass testing such as in SSB applications.

The unit has been designed for simple operation. A backlit LCD display shows parameters and function settings at a glance. Conventional multiple bushbuttons are replaced by a large multifunction rotary control, with a limited number of keys for mode and parameter selections.

For further information circle 270 on the reader service coupon or contact Philips Test & Measurement, 34 Waterloo Road, North Ryde 2113' phone (02) 888 8222.

hesive aluminium foil base. With a 50% overlap wrapping over cables, bundles, tubes, hoses, etc., it produces a very flexible four ply shielding.

Supplied in five metre rolls of 25mm width, Zipmesh can be used for shielding repairs, cable splicing, and highly flexible signal cables and harnesses. It can also be supplied in 75mm width, and with copper foil.

For further information circle 244 on the reader service coupon or contact Electromark, PO Box 134, Mortdale 2223;phone (02) 533 3322, fax 534 6360.

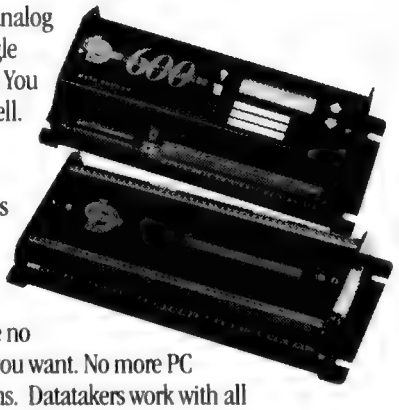
Micro-controlled power supplies

Kenwood has just released a new range of microcomputer controlled laboratory power supplies.

There are eight supplies in the range, covering voltages up to 30V and current up to 2A. A selection can be made from single or multiple outputs, plus all outputs are floating and can be used on the dual tracking mode. Each supply has three independent pre-set output memories so the user can pre-program the more commonly used output voltages and currents. Up to four units can be connected for master/slave operation for system applications. Both GPIB and RS232 interface connections are also provided, enabling up to 40 separate power supplies to be interconnected and to operate as both listener/talker for total system control.

For further information circle 245 on the reader service coupon or contact Nilsen Instruments, PO Box 930, Collingwood 3066; phone (03) 419 9999, fax (03) 416 1312. ❖

The world's best data logger just got bigger.



Now you can log up to 150 analog and 84 digital inputs with a single Datataker 500 or Datataker 600. You get up to 44 digital outputs as well. It's simply a matter of adding Channel Expansion Modules.

Channel Expansion modules support all the standard Datataker features.

Any sensor, any mix. With Datataker you choose. There are no restrictions to working the way you want. No more PC cards and compatibility problems. Datatakers work with all computers, any operating system.

Whatever your application there is a Datataker solution. You can network Datatakers on a standard twisted pair, over telephone and radio modems or via satellite link.

Call our application engineering staff to discuss your application, get full information or arrange a demonstration.

Data Electronics 7 Seismic Court, Rowville Vic. 3178.
Tel: (03) 764 8600. Fax: (03) 764 8997.

AUDIO VISION

LaserDisc -
THE FUTURE OF SOUND AND VISION IS HERE NOW!

- LaserDisc is the ideal medium for movie collector's offering pictures and sound of the highest quality.
- There is a range of over 7000 titles available on NTSC LaserDisc, including some excellent computer animation and director's cuts of movies.
- There is no wear and tear involved unlike video tape.
- Your LaserDisc player can now also play CD's, and so represents the centre of your home entertainment system.
- Most movies on LaserDisc now have encoded **surround sound** on them, as well as **closed captioning** for the deaf or hard of hearing.

Audio Vision is the leader of LaserDisc technology in Australia, and can help you with your needs.

- for more information, please contact us on :

P.O Box 135
Bentleigh Vic 3024
Telephone: (03) 532 8500
Facsimile: (03) 532 8725

The future is very clear with LaserDisc

READER INFO NO. 22

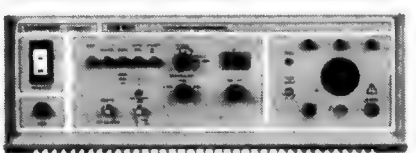
Very Affordable and Precise Fast Transient Burst Simulator conforms to New IEC 801-4 and other International Standards

The benefits . . .

- Maintenance-free solid-state HV switch
- Continuous operation without re-calibration (in-built DVM)
- Test voltages up to 4400 V
- Burst frequencies up to 10 kHz
- Single pulse capability
- Integrated coupling network
- Ideal for LAB, FIELD, R&D and quality assurance
- Very fast 5 ns rise time pulses
- Various trigger and gating modes

Standards such as the IEC 801-4, DIN/VDE 0843-4 CENELEC HD 481.4, etc call for interference voltage tests to be carried out on instruments and systems using pulse bursts similar to those that occur in real life when electrical equipment is switched on or off, or when it is plugged in or disconnected.
Electronic circuits of all types, especially modern digital equipment, are very sensitive to these types of interference pulses.
The NSG 1025 Generator simulates such interference sources. The specifications of the pertinent Standards are met and, particularly where precision and reproducibility are concerned, are often exceeded. A new type of solid state high voltage switch ensures excellent pulse parameter stability and maintenance-free continuous operation.

SCHAFFNER NSG 1025



Optional accessories include 3 phase coupling network, capacitive clamp and data line coupler.

Your guarantee of Quality ...

SCHAFFNER AND WESTINGHOUSE are both certified to ISO 9001 (AS 3901)

For more details contact John Thompson
Tel: (03) 391 1300 Fax: (03) 391 6607
59 Stephenson St., Spotswood Vic 3015
P.O. Box 4 Newport Vic 3015

Westinghouse
BRAKE & SIGNAL COMPANY
INDUSTRIAL PRODUCTS

YES! Please send FREE Application Notes and selection data regarding simulators for: (tick)

- ☐ IEC 801-4 Fast Bursts
- ☐ IEC 801-5 High Energy
- ☐ IEC 801-2 Electrostatic discharge
- ☐ Telecoms CCITT-K17, K20 etc
- ☐ Insulation Testing (AC/DC)

Name .....
Company .....
.....
Address .....
Phone No. (.....) .....
Fax No. (.....) .....

READER INFO NO. 43

Silicon Valley NEWSLETTER

Clinton unveils program in Silicon Valley

Silicon Valley's prestige and role in shaping America's future economy got another huge boost when President Clinton and Vice President Al Gore travelled to the Valley to unveil their high-tech government policy, following a tour of graphics workstation maker Silicon Graphics in Mountain View.

The Monday morning visit to Silicon Graphics followed a 'ties-optional' dinner Sunday evening at a Los Gatos restaurant, hosted by Apple chairman John Sculley. The idea for the trip was originated during a telephone call Clinton placed to Sculley at his Washington DC hotel room, less than an hour after he finished his address to both Houses of Congress to launch his economic plan. Sculley, who has become a close friend and ally of the Clintons, had been seated prominently next to First Lady Hillary. Clinton called on Sculley to get a first reaction to his proposals.

The dinner with 40 of Silicon Valley's top high-tech executives was partly a payback for the support most of the attending guests had given Clinton during the last two months of the campaign. But more important than that, it gave both Clinton and Vice President Gore an opportunity to talk high-tech with two dozen of Silicon Valley's most prominent high-tech industry leaders and lobby them for support for their complex economic revival program. During dinner, Clinton and Gore rotated through the room of a dozen or so round tables.

"We may have a low bit rate, but we have high resolution," joked Gore, who is Washington's premier user of personal computers and other high-tech gear. Then, turning to Clinton, Gore added "This is one of the few audiences where I can use that line."

A few hours earlier, at his arrival at the Moffett Field Airfield in Mountain View, Clinton said that reviving the California economy was at the top of his list of priorities and the state's high-tech industry will play a key role in achieving a turn-around from the three year recession, brought on by slumps in the defence and aerospace industries. "Unless California revives, the nation cannot recover economically. We've got to cut spending, we've got to increase some taxes, and we have got to invest in America..."

Firms such as Apple Computer, Motorola, AT&T, General Magic and EO have been generating considerable hype about the potential of the new 'personal communicator' and 'personal digital assistant (PDA)' products they have in development. However, industry analysts believe these devices will probably take many years to establish a mass market.

After touring Silicon Graphics, where they were shown the dazzling graphics capabilities of the company's new graphics supercomputer, Clinton and Gore unveiled details of their high-tech policy, large parts of which reflected his campaign program which was drawn up in large part by a group of 24 Silicon Valley high-tech executives, including Sculley.

- Some of the key points of Clinton's high technology policy included:
  Build a 21st century infrastructure both for roads, high speed railways, and an optics-based data network that would reach into every home and business and open the door to vast new industries delivering scores of new services not possible with today's communications network.
- Improve education and training. Clinton announced he is ordering the release of the first US$500 million to retrain laid-off defence and aerospace workers, who mostly are located in Southern California and the Seattle area.
- Require all Federal agencies to set aside 1.25% of their annual R&D budget for assistance to small business trying to develop new high-tech products and services. Agencies would be required to develop programs to issue grants to companies involved in developing environmentally oriented technologies and products.
- Make the current R&D tax credit a permanent part of the US tax code.
- Shift military research spending to civilian research. Clinton said the combined expenditures on rebuilding America's infrastructure could exceed the US$500 billion in defence cuts planned over the next five years.
- Speed up the process of transferring government owned technology to the private sector for application in commercial ventures. Increasingly, Clinton said, the government will get involved in joint government/private industry research and development projects such as Sematech, to help boost American competitiveness in a host of critical mass markets of the future.
- Finally, Clinton called for the overhaul of the tax system to create tax-based investment incentives, including his pledge last week to see a sharp reduction in capital gains taxes on income earned on investments in companies with sales less than US$50 million a year.

Clinton's visit to Silicon Graphics was no coincidence. The company closely resembles the kinds of companies Clinton has been envisioning for the future. Silicon Graphics is a company where image is literally everything and provided a perfect backdrop for Clinton to unveil his high-tech policy program.

In Clinton's vision of a stronger, smarter economy, the President is pushing Silicon Graphics as a corporate blueprint for others to follow. For one, SG was founded in 1982 by a Stanford professor

who based his company on new graphics display technology he helped develop while working with the Defence Department — exactly the type of government/business relationship Clinton is proposing in his high-tech policy. And more than half the company's US$886 million in 1992 sales were generated abroad, while virtually all production is domestic.

HDTV contenders told to co-operate

The American effort to develop an industry standard for future high-definition television took one step forward and two steps backward when the Federal Communications Commission's HDTV panel recommended that the three US-based HDTV initiatives get together and blend their respective technologies into a single standard. While the combination of the best features of the three all-digital proposals would likely result in a much better standard, the move will delay the FCC's adoption of a US HDTV standard for as much as one year.

Meanwhile, the FCC panel formally rejected the HDTV proposals submitted by Japan's broadcasting authority NHK, and rejected any analog-based technology for US HDTV.

Following 16 months of testing, none of the three all-digital proposals emerged as clearly superior over the other two, prompting the FCC to seek co-operation among the contenders to unify their effort. Already the groups lead by General Instruments/MIT and Zenith/AT&T have agreed to work together. The two have invited the initiative sponsored by NBC, Philips, Thomson, Compression Labs and David Sarnoff Research Center to join them in developing a unified standard.

Industry watchers said one of the biggest problems facing such a massive alliance would be to figure out a system for dividing the royalties each member of the alliance would be due, from a combining of the various technologies.

Engineers leaving IBM R&D laboratory

As IBM continues to take on more water, reports are beginning to circulate about a large number of IBM's best engineers jumping ship at the Thomas J. Watson laboratory, one of the world's premier science and engineering labs.

Reportedly, resumes from many of the lab's top engineers are already being circulated throughout the industry. At Microsoft, Nathan Myhrvold who is manager of advanced technology said his company has hired entire teams of Watson engineers. Most are willing to move across the US to join the much smaller research facilities at Microsoft.

Officially, IBM has stated that it will not allow vital employees to take advantage of the lucrative buy-out programs for early retirement. But apparently dozens of top engineers have been able to take the option.

In its current fiscal turmoil, long term scientific research is quickly becoming a luxury IBM can no longer afford to subsidise, causing it to shed even some of the brightest engineers.

US-Japan chip confrontation looms

Japan's electronics industry is bracing itself for the inevitable confrontation it faces with the pro-Silicon Valley Clinton Administration, over the issue of chip trade between the US and Japan and the latter's continued failure to meet the terms of either of two consecutive chip trade agreements.

High-level Clinton Administration officials have started to lay the foundation for the coming confrontation, which was expected to come to a head on March 19 when Japan released its fourth quarter market share figures.

In anticipation of Japan's failure to meet the 20% level spelled out in the trade agreement, Clinton officials said that they are 'dissatisfied' with Japan's compliance with the 1991 chip trade agreement. But the same officials also indicated that they support a majority view among US chip industry executives that sanctions should not be imposed immediately. Rather, the failure to perform and the justification for sanctions should be used as leverage to put new pressure on Japan's electronics industry to increase purchases of foreign chip products.

"To be sure, our sales in the Japanese market have climbed somewhat, but the results to date are not sufficient," said US Trade Representative Mickey Kantor. Kantor's remarks came just two days after he and Commerce Secretary Ron Brown met with a delegation of chip industry executives in Washington.

James Norling, president of Motorola's semiconductors operations and the 1993 chairman of the Semiconductor Industry Association, said his group may still call for sanctions against Japan, but only as a last resort option. "There would be a handful of options and that would be one of them."

He added that the SIA would not call for sanctions, if, for example, Japan were to pledge that foreign chip churchases in 1993 would average 20%.

Industry observers noted that while such a pledge would take some immediate pressure off and avoid an outright trade conflict, a pledge for an average 20% market share may still be beyond what Japan is willing to give up.

It means that by the end of 1993, market share would have to be in the 22 - 24% range in order to achieve the average. That would be an 8% increase from current levels. Even with two trade agreements, annual market share improvements have never exceeded even 3%.

But many believe most US officials will be satisfied if Japan at least achieves the 20% level by the end of this year.

DEC enters disk drive market

Until very recently, the disk drive market has been dominated by a small group of Silicon Valley companies: Seagate, Maxtor, Connor Peripherals, and Quantum. But the Big Four now have a powerful new competitor — Digital Equipment, which has announced a bold plan to become a leading vendor of disk drives for the high-end PC, workstation and mincomputer markets.

Digital said it will mount an aggressive campaign to become a major vendor of disk drives with 500MB of data storage or more. The company has launched four drives with capacities ranging from 553MB to 2.1GB of data.

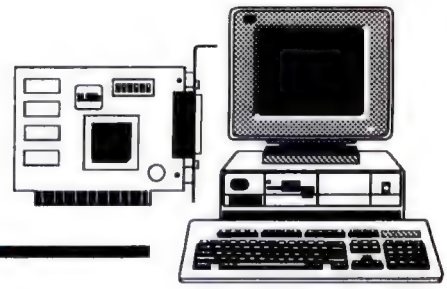
"Our target is to be at US$1 billion in calendar year 1994," boasted Jack Sharp, who manages DEC's disk drive operations. That would be a huge increase from the US$200 million in 1993 disk drive revenues DEC is projecting.

Analysts think DEC stands a fairly good chance to make good on its promise. The high end side of the market remains wide open for new competitors as the limited size has forced the major vendors to focus their efforts on the mainstream PC market, where 100 - 200MB remains the high end of the average storage capacity. But storage needs are exploding as multi-media applications, which consume huge amounts of data when working will full motion video, sound and complex graphics proliferate.

DEC has been making disk drives for many years, but limited their use for its own computers. In 1990 the company initiated a program to sell its drives on the open market on a limited basis.

Now, as the company struggles to recover from its financial problems, the firm, just like IBM, is starting to use all of its technological assets in the market place to realise maximum return on investment. ❖

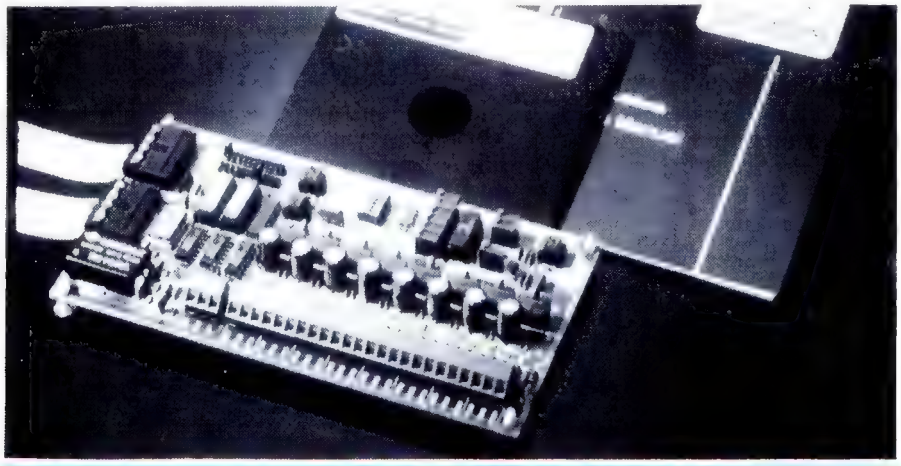
Computer News and New Products



Isolated relay, multiplexer board

The PCLD-779 offers convenient front end signal conditioning and channel multiplexing to the analog inputs found on PC-LabCard's DAS cards. It multiplexes up to eight differential input channels to one A/D input channel.

The board has been designed for the cost sensitive customer who requires precision low level signal measurement and isolation for industrial applications such as multi-channel thermocouple measurements. It incorporates capacitor coupling and relay multiplexing into its onboard technology. It provides over 1000V DC of channel-to-channel and input-to-output isolation.



This board is equipped with a high grade instrument amplifier, with six switch selectable gains of x1, x10, x50, x100, x200 and x1000. This feature allows the user to acquire accurate voltage measurements from low level signals over a wide range of amplification.

The PCLD-779 is also equipped with its own cold junction sensing circuit (CJC). The CJC allows the user to make direct temperature measurements from thermocouple transducers. A wide variety of thermocouples are supported by the PCLD-779 via software compensation and linearisation.

New Samsung desktop and notebook PCs

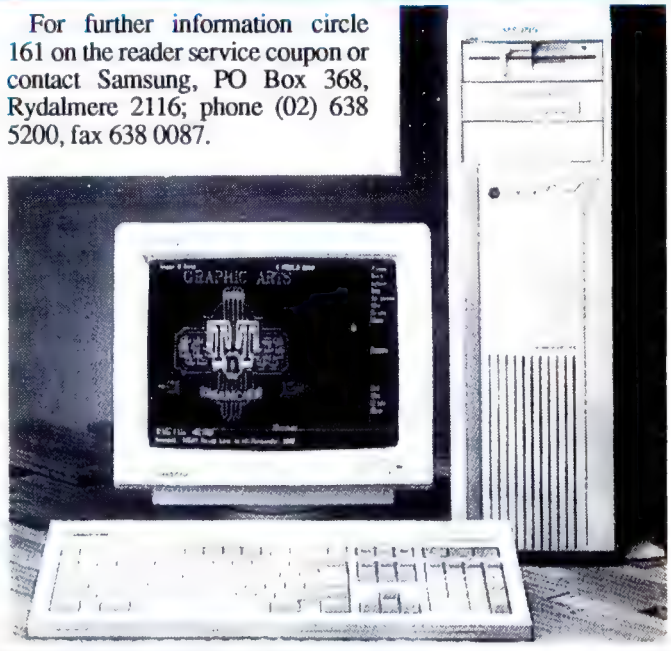
Samsung Electronics has launched a complete new line of 486 Desktop and Notebook computers with many improved features, including Local-Bus video, non-interlaced, flicker-free monitor support and significant performance improvements.

Samsung's new 486 DeskMaster (desktop) and SysteMaster (tower) PC range includes four new desktops and one tower, all with high speed Local-Bus video with graphics accelerator.

Three of the desktop models are 16-bit AT-bus models, while one desktop and the tower model are 32-bit EISA bus architecture. All models are available in three configurations: no hard disk or fitted with a 120MB or 250MB IDE hard disk drive.

Two new 486 NoteMaster notebooks have also been released; one uses the economical Cyrix 486SLC processor while the other uses Intel's proven 486SX. Both models are extremely light and compact, with superior video performance via 64 grey-scale 10" LCD displays which can display simultaneously with an external colour monitor. All notebooks have Samsung's DriveMaster system, with its removable hard disk drive, which can also be docked in any desktop PC by using the optional DriveMaster receptable.

For further information circle 161 on the reader service coupon or contact Samsung, PO Box 368, Rydalmere 2116; phone (02) 638 5200, fax 638 0087.



For further information circle 162 on the reader service coupon or contact Priority Electronics, 5/23 Melrose Street, Sandringham 3191; phone (03) 521 0266, fax 521 0356.

Protel Easytrax now freeware

Protel Technology has released its popular Easytrax V2.06 PCB layout software, for IBM compatibles, as freeware.

The freeware version of Easytrax V2.06 is identical to the fully licensed version, which previously sold at $395.00, but does not include a reference manual or Protel's standard 90 days of free software support.

While stocks last, Protel is selling the fully licensed version of Easytrax for $150. Purchasers of this version are entitled to upgrade discounts off Protel's other products — Protel for DOS (Autotrax and Schematic) and the Protel for Windows range. To obtain a copy of the Easytrax freeware send a floppy disk either 1.2Mb/5.25" or 1.44Mb/3.5" to Protel Technology.

For further information circle 163 on the reader service coupon or contact Protel Technology, GPO Box 204, Hobart 7001; phone (002) 73 0100, fax 73 0900.

Digital still camera upgraded

The Dycam model 3 Digital Camera is now available with many updated features, plus a major price reduction. Compared to the previous model, the model 3 offers users increased resolution, longer battery life, and a better dynamic range. It is also equipped with new software, capable of increasing its usefulness to all computer users.

An important new feature is the Digital Motion Software (DMS), which allows a user to 'see through the lens'. In a DOS application, 1/2 to 1/8 sized snapshots of an original image can be displayed on a monitor at two to three times per second, with a resolution of 2, 4, or 8-bits per pixel. Unlike a video image, the file size is less than 30K bytes, which makes it ideal for any remote imaging application. Use of the included program 'Baud' allows the camera to be directly linked to a Hayes modem for remote imaging applications.

The DMS software is ideal for use with the camera's optional lenses, or when devices such as microscope, telescopes or other applications that require 'SLR' functionality are attached.

New software with the model 3 will provide complete image editing facilities under DOS, Windows and Mac operating systems. This includes a full gamma correction facility with the ability to turn the flash on and off.

The Dycam camera is now priced at $1495 including all software, down from the original $1895 (excluding tax).

For further information circle 164 on the reader service coupon or contact Sprinter Products, PO Box 259, Manly 2095; phone (02) 977 8155, fax 976 2442.

Multifunction DA board

National Instruments Australia has announced a new high performance multifunction data acquisition board. The AT-MIO-16X is a high resolution analog, digital and timing I/O board for PC AT and compatible computers, with sustained analog sampling rates up to 100kHz. Engineers and scientists can use the AT-MIO-16X to build PC-based acquisition systems for laboratory automation, process monitoring and control, automotive and aerospace engineering, and electronic test applications.

The AT-MIO-16X has a 16-bit sampling ADC with up to 16 analog inputs that can be configured as 16 single-ended inputs, 16 pseudo-differential inputs with a shared common, or eight fully differential inputs.

It uses the National Instruments custom instrumentation amplifier, the NI-PGIA, which guarantees high accuracy when scanning multiple analog input channels at high rates with high gains. The board's two independent double buffered, multiplying 16-bit DACs are connected to two voltage output channels.

The input and output range polarity, input gain, and input mode (differential or single-ended) are fully software selectable on a per channel basis.

The AT-MIO-16X has eight lines of transistor-transistor logic (TTL) compatible digital I/O that can sink 24mA on each line. Its three 16-bit counter/timer channels can be used for frequency measurement, event counting, and pulse output applications. With a 512-word analog input FIFO buffer, a 2k word (1 word is 32 bits (analog output FIFO buffer and dual channel DMA, it guarantees high throughput rates for both analog input and output.

Software for the AT-MIO-16X includes NI-DAQ, the company's library of data acquisition functions for DOS and Windows applications; and DAQWare, a ready-to-run system containing analog, digital and counter/timer I/O routines. The board's data acquisition functions can also be controlled with LabWindows for DOS or LabVIEW for Windows.

For further information circle 170 on the reader services coupon or contact National Instruments Australia, PO Box 466, Ringwood 3134; phone (03) 879 9422, fax 879 9179.

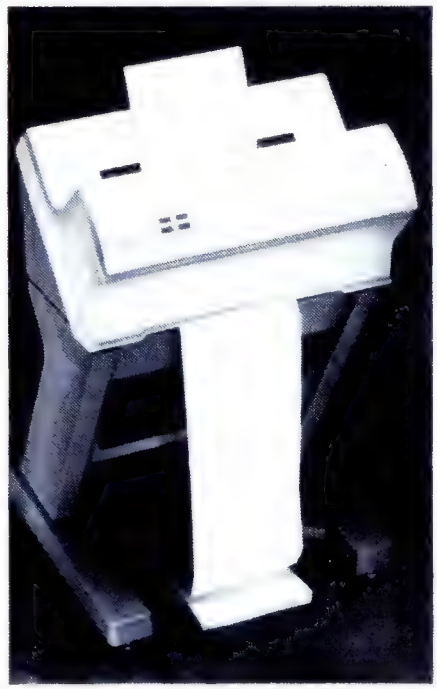
COMPUTER PRODUCTS

High speed printer

Dataproducts Corporation has released an updated version of its high speed matrix printer, with an option for network connectivity. The new Rebel printer is rated at an outstanding 1800 characters per second and uses a 33-pin printhead that prints three lines of text simultaneously for 600lpm throughput (in 80 column draft mode at 10 characters per inch).

Designed with the MIS and DP departments in mind for financial and accounting reports, the Rebel is also the ideal printer for shipping, receiving, labels, lists, forms and OCR and bar code applications. An optional QMS controller is available to simplify bar code, label and invoice design and printing.

A triple interface is standard on the Rebel, with Dataproducts LB series, Printronix P-6040, IBM ProPrinter and Epson emulations.



As mentioned, a QSM MAGNUM emulation card is optional for bar code and graphics work. For networking applications, the Dataproducts XPN-10 adaptor allows the printer to be directly connected to a Novel network.

Rebel is priced at $6950 (excluding tax) or $7695 for the 'Demand Document' version.

For further information circle 167 on the reader service coupon or contact Dataproducts, 10 Rodborough Road, Frenchs Forest 2086; phone (02) 451 3533, fax 975 1652.

Multiple keyboards and monitors for PCs

Perfect for industrial and educational use, the Cyber Expander is a multi-port video buffer with an electronic keyboard switch. Both 4-port and 8-port versions are available. Since only one keyboard can be active at any time, no software is required. Keyboard switching is automatic, with a switch selectable timeout.

An Expander system consists of a multi-port transmitter with associated input cable and AC transformer, linked to one or more receiver units.

Each receiver supports a keyboard, or monitor, or both, and is connected to the transmitter by an extension cable up to 180 metres long. Standard receivers are limited to a 75 metre extension; extended distance units are available upon request.

The transmitter has ports for a local keyboard and monitor, control switch and power indicator LEDs. The 4-port version has three expansion ports, while the 8-port unit has seven. Display types supported include Mono, CGA, EGA, VGA and Super VGA.

For further information circle 175 on the reader service coupon or contact Boston Technology, PO Box 1750, North Sydney 2059; phone (02) 955 4765, fax 955 4468. ❖

Hakko 926 Soldering Station

The Hakko 926 is a super-quick heat-up (3 sec cycle) and fast recovery iron offering high quality soldering at lower tip temperatures. The built-in ceramic heater maintains temperature to within 0.5°C of the setting. Yes this is an ADJUSTABLE temperature iron covering the range from 200°C to 480°C using a full wave zero-crossing switching system. Meets MIL-STD-2000 and operates at safe 24V.

Also available in ESD for antistatic environments. We stock a wide range of tips to suit. Ask for listing.

$183.95

Special while stocks last we are giving away FREE with every Hakko 926 iron a pair of Hakko bent nose pliers worth $33.30! This is to introduce you to these lightweight, precision tools which we are now stocking. The 112 plier is for those awkward locations and has a length of 130mm

Currently available in the Hakko tool range for the IC age are –

103

103 Edge Nippers with oblique-edge pointed tips giving extra reach for cutting wires up to 1mm dia. 115mm long. **$33.30**

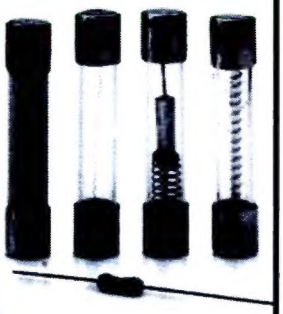
112

101 Micro Nippers. 100mm long. **$33.30**

112 Bent Nose Pliers 130mm long. **$33.30**

NOW STOCKING BUSSMANN FUSES

We are now stocking an extensive range of fuses and holders from Bussman. These include special replacement fuses such as the KTK series fast acting fuses for Fluke multimeters etc. We also stock the Microtron subminiature axial lead fuses and Pico ranges, IEC approved types etc.



The HKP Series Universal Fuseholders take standard M205/3AG fuses and have a vibration resistant bayonet cap.
Introductory price **$2.95**

APPA

Looking for Value in Multimeters?

- ***Extra tough for industrial users***
- ***High energy fuse and PTC protection against overloading***
- ***O-ring sealed case, switch and jacks against dirt and moisture***
- ***Protective holster and tilt stand with lead storage***
- ***Test probes have finger shields and sleeved plugs***
- ***Thick walled ABS case and shock mounted LCD withstands 2m drop on to concrete floor***
- ***Unique rotary switch with berylium copper contacts and gold plated pcb***

Model 103 & 105
- 4000 count
- Digital update twice/second, analog 20 times/sec
- 8 Functions - Vdc, Vac, Adc, Aac, Ohms, Diode, Continuity, Frequency, Capacitance
- Data hold & Relative functions
- 0.5% dc accuracy

$298.80 $249.00 ex tax

Ranges
Vdc 400mV, 4V, 40V, 400V, 1000V
Vac 4V, 40V, 400V, 750V
Adc 4-400mA, 10A
Aac 4-400mA, 10A
Ohms 400Ω, 4kΩ, 40kΩ, 400kΩ, 4MΩ, 40MΩ
Frequency 100Hz, 1kHz, 10kHz, 100kHz, 1MHz
Capacitance 4nF, 40nF, 400nF, 4μF, 40μF

Model 105 has similar specs but with improved accuracy of 0.1% typ on Vdc and 0.5% at 50Hz

$358.80 $299.00 ex tax

Silicone Test Leads & Accessories

Sick of those stiff plastic test leads that come with most multimeters? You know the ones that kink and produce pungent smoke when you touch them with a hot soldering iron? Well chuck them out and look at our super quality HCK Silicone Rubber leads. You wouldn't believe that a 1000V/16A cable could be so flexible. And they're soldering iron proof to 300°C. So give your test instruments a new lease of life.
We stock one of the largest ranges of test leads and accessories available.

Cable

HCK-7062-1/5M	0.25mm Silivolt Cable	$10.95
HCK-7062-2/5M	0.25mm Silivolt Cable	$10.95
HCK-7062-1/100M	0.25mm Silivolt Cable	$141.25
HCK-7062-2/100M	0.25mm Silivon Cable	$141.25
HCK-7066-1/5M	0.75mm Silivolt 5m	$21.85
HCK-7066-2/5M	0.75mm Silivolt 5m	$21.85
HCK-7066-1/100M	0.75mm Silivolt 100m	$360.85
HCK-7066-2/100M	0.75mm Silivolt 100m	$360.85
HCK-7008-1/100M	1.00mm Flexivolt Cable	$121.00
HCK-7008-2/100M	1.00mm Flexivolt Cable	$121.00

2mm Test Leads

HCK-MS101	2mm Blk 1.0m Lead	$10.20
HCK-MS102	2mm Red 1.0m Lead	$10.20

2mm Test Fittings

HCK-8234-1	2mm Blk Hook Grip	$4.20
HCK-8234-2	2mm Red Hook Grip	$4.20
HCK-9217-1	2mm Blk Stackable Plug	$1.60
HCK-9217-2	2mm Red Stackable Plug	$1.60
HCK-9225-1	2mm Blk Test Prod	$3.25
HCK-9225-2	2mm Red Test Prod	$3.25
HCK-9229-1	2mm Blk Test Tweezers	$14.05
HCK-9229-2	2mm Red Test Tweezers	$14.05

4mm Test Leads

HCK-9014-1	4mm Blk Stght 1.0m Lead	$12.95
HCK-9014-2	4mm Red Stght 1.0m Lead	$12.95
HCK-9014-3	4mm Blu Stght 1.0m Lead	$12.95
HCK-9014-4	4mm Yel Stght 1.0m Lead	$12.95
HCK-9016-1	4mm Blk R/A 1.0m Lead	$13.80
HCK-9016-2	4mm Red R/A1.0m Lead	$13.80
HCK-9024-1	4mm Blk Stght 1.0m Lead	$14.20
HCK-9024-2	4mm Red Stght 1.0m Lead	$14.20
HCK-9026-1	4mm Blk R/A 1.0m Lead	$14.65
HCK-9026-2	4mm Red R/A 1.0m Lead	$14.65
HCK-9023-1	4mm Blk Sfty 1.0m Lead	$11.80
HCK-9023-2	4mm Red Sfty 1.0m Lead	$11.80
HCK-9025-1	4mm Blk Sfty R/A 1.0m	$12.25
HCK-9025-2	4mm Red Sfty R/A 1.0m	$12.25
HCK-S051	4mmBlk16A 0.5m Lead	$9.80
HCK-S052	4mm Red 16A 0.5m Lead	$9.55
HCK-S053	4mm Blu 16A 0.5m Lead	$9.80
HCK-S054	4mmYel 16A 0.5m Lead	$9.80
HCK-S055	4mm Grn 16A 0.5m Lead	$9.80
HCK-S056	4mm Vio 16A 0.5m Lead	$9.80
HCK-S101	4mm Blk 16A 1.0m Lead	$10.60
HCK-S102	4mm Red 16A 1.01U Lead	$11.80
HCK-S103	4mm Blu 16A 1.01U Lead	$11.80
HCK-S104	4mm Yel 16A 1.0m Lead	$11.80
HCK-S105	4mm Grn 16A 1.0m Lead	$11.80
HCK-S106	4mm Vio 16A 1.0mLead	$11.80
HCK-S201	4mm Blk16A 2.0m Lead	$15.80
HCK-S202	4mm Red 16A 2.0m Lead	$15.80

4mm Test Leads (cont)

HCK-S203	4mm Blu 16A 2.0m Lead	$15.80
HCK-S204	4mm Yel 16A 2.0m Lead	$15.80
HCK-S205	4mm Grn 16A 2.0m Lead	$15.80
HCK-S206	4mm Vio16A 2.0m Lead	$15.80
HCK-S151	4mm Blk 16A 1.5m Lead	$13.75
HCK-S152	4mm Red 16A 1.5m Lead	$13.75
HCK-S153	4mm Blu 16A 1.5m Lead	$13.75
HCK-S154	4mm Yel 16A 1.5m Lead	$13.75
HCK-S155	4mm Grn 16A 1.5m Lead	$13.75
HCK-S156	4mm Vio 16A 1.5m Lead	$13.75

2mm to 4mm Adaptors

HCK-9227-1	4mm/2mm Blk Adaptor	$2.65
HCK-9227-2	4mm/2mm Red Adaptor	$2.65

4mm Test Fittings

HCK-9120-1	4mm Blk Clamp Grip 50mm	$14.30
HCK-9120-2	4mm Red Clamp Grip 50mm	$14.30
HCK-9123-1	4mm Blk Coupling XHK	$2.20
HCK-9123-2	4mm Red Coupling XHK	$2.20
HCK-9295-1	4mm Blk Crocodile 34A	$5.05
HCK-9295-2	4mm Red Crocodile 34A	$5.05
HCK-9209-1	4mm Blk Crocodile 2A	$2.80
HCK-9209-2	4mm Red Crocodile 2A	$2.80
HCK-9206-1	4mm Blk Hexagonal Probe	$3.60
HCK-9206-2	4mm Red Hexagonal Probe	$3.60
HCK-9112-1	4mm High Voltage Prod	$4.95
HCK-9112-2	4mm Red High Volt Prod	$4.95
HCK-9113-1	4mm Blk High Volt Prod	$5.55
HCK-9113-2	4mm Red High Volt Prod	$5.55
HCK-9116-1	4mm Blk Hook Grip	$12.85
HCK-9116-2	4mm Red Hook Grip	$12.85
HCK-9119-1	4mm Blk Jaw Grip	$19.95
HCK-9119-2	4mm Red Jaw Grip	$19.95
HCK-9124-1	4mm Blk Adaptor XSA	$4.45
HCK-9124-2	4mm Red Adaptor XSA	$4.45
HCK-9214-1	4mm Blk Panel Mount Socket	$4.35
HCK-9214-2	4mm Red Panel Mount Socket	$4.35
HCK-9132-1	4mm Blk Panel Twin Socket	$4.70
HCK-9132-2	4mm Red Panel Twin Socket	$4.70
HCK-9205-1	4mm Blk Square Probe	$3.20
HCK-9205-2	4mm Red SquareProbe	$3.20
HCK-9203-1	4mm Blk Stackable Phg	$3.25
HCK-9203-2	4mm Red Stackable Plug	$3.25
HCK-9230-1	4mm Blk Test Tweezers	$13.70
HCK-9230-2	4mm Red Test Tweezers	$13.70

Ultrasonic Cleaner

The high tech way to clean PCB's, switches, watches, drafting pens etc. Tiny cavitation bubbles clean the surface 40000 times per second. 165x90x50mm stainless steel container holds half a litre.

Excellent value at **$195.00**

DIC SC-7000 DeSoldering Tool – ESD* Protected

- Now with 100W ceramic heater
- Sensor feedback digital temperature control
- * Special antistatic housing and zero crossover switching to protect sensitive components
- Suction/Hot air blow switch – suck for desoldering, blow for SMD removal
- Work on up to 12 layer boards
- Optional surface mount kit

$482.50 ex tax
$579 inc tax

24-Hour Sidereal Clock Chip Set

Special pack for the Silicon Chip March 93 project for astronomers, contains the PCF1171 clock chip and LCD display **$49.90**

8.30am to 5.00pm Mon to Fri. 8.00am to 12 noon Saturday.
Mail Orders add $5.00 min to cover postal charges.
Next day delivery in Sydney add $8.00.
All prices include Sales tax unless stated otherwise.
Tax exemption certificates accepted if the line value exceeds $10.00.
BANKCARD, MASTERCARD, VISA, CHEQUES or CASH cheerfully accepted. **READER INFO NO. 32**

GEOFF WOOD ELECTRONICS

Geoff Wood Electronics Pty Ltd and Semtech

(inc in N S W)

229 Burns Bay Road, Lane Cove West
N S W 2066 (Corner Beatrice Street)

Telephone : (02) 428 4111 Fax : (02) 428 5198

EA DIRECTORY OF SUPPLIERS

Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

Supplier	State	A	B	C	D	E	F	G
Altronics	WA	•	•	•	•	•	•	•
Companion Computers	VIC		•					
Dick Smith Electronics	ALL	•	•	•	•	•	•	•
Emona Instruments	NSW						•	
Geoff Wood Electronics	NSW	•	•	•	•	•	•	
Jaycar Electronics	Eastern	•	•	•	•	•	•	•
Kalex	VIC			•				
Macservice	VIC						•	
RCS Radio	NSW			•				
Rod Irving Electronics	VIC	•	•	•	•	•	•	•
Scientific Devices	VIC						•	
TECS	VIC	•	•	•	•	•	•	•
Wagner Electronics	NSW		•		•	•	•	

KEY TO CODING:
A Kits and modules
B Tools
C PC boards and supplies
D Components
E IC chips and semiconductors
F Test and measuring instruments
G Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Co, PO Box 199, Alexandria 2015; phone (02) 353 9944.
BACK ISSUES: Available only until stocks are exhausted. Price A$7.50 which includes postage within Australia only. **OVERSEAS READERS SHOULD ADD A FURTHER A$2.50 FOR EVERY BACK ISSUE REQUIRED.**
PHOTOSTAT COPIES: When back issues are exhausted, photocopies of articles can be supplied. Price $7.50 per project or $15 where a project spreads over several issues.
PCB PATTERNS: High contrast, actual size transparencies for PCBs and front panels are available. Price is $5 for boards up to 100sq.cm, $10 for larger boards. Please specify negatives or positives.
PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications.
Members of our technical staff are not available to discuss technical problems by telephone.
OTHER QUERIES: Technical queries outside the scope of 'Replies by Post', or submitted without fee, may be answered in the 'Information Centre' pages at the discretion of the Editor.
PAYMENT: Must be negotiable in Australia and payable to 'Electronics Australia'. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).
ADDRESS: Send all correspondence to: The Secretary, Electronics Australia, P.O. Box 199, Alexandria, NSW 2015; phone (02) 353 0620.
PLEASE NOTE THAT WE ARE UNABLE TO SUPPLY BACK ISSUES, PHOTOCOPIES OR PCB ARTWORK OVER THE COUNTER.

METHOD OF PAYMENT: (Please circle correct method).

Credit Card: Mastercard / American Express / Visa / Bankcard
Cheque:
Money Order:
Expiry Date: .....

Name:.....
Address:.....
.....Postcode:.....
Back Isues:.....
.....
.....
Photostat Copies:.....
.....
.....

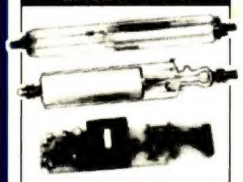
No.of issues required:.....$7.50=.....
No.of copies required:.....$5.00=.....
No.of copies required:....$15.00=.....
Total Payment Enclosed $ =========

Signature:.....
(Unsigned orders cannot be accepted).

ADVERTISING INDEX

This index is provided as an additional service. The publisher does not assume any liability for errors or omissions.

12V OPERATED LASER TRIO



One used 3mW Siemens tube, one used laboratory quality 2mW tube, one universal 12V laser inverter kit, for a total of:

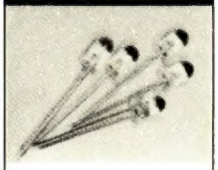
$99

FANS

Brand new German made PAPST brand 115V-12W fans with metal blades. Overall dimensions 80 X 80 X 38mm. Use two in series to run off mains?

LIMITED STOCKS **$14**

HIGH INTENSITY LED's



Narrow angle 5mm red LED's in a clear housing. Have a luminous power output of 550-1000mCD @ 20mA: That's about 1000 times brighter than normal red LED's.

SPECIAL UNBELIEVABLE INTRODUCTORY PRICE:

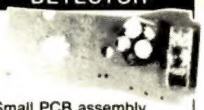
50c ea. or **10 for $4,** or **100 for $30.**

DYNAMIC MICROPHONE

Stage quality Unidirectional (Cardioid) 600ohm dynamic microphone in a black metal housing. Has ON-OFF switch and cannon connector. Prewired lead and clip provided.

$39

LIGHT MOTION DETECTOR



Small PCB assembly based on a ULN2232 IC. This device has a built in light detector, filters, timer, narrow angle lens, and even a siren driver circuit that can drive an external speaker. Will detect humans crossing a narrow corridor at distances up to 3 metres. Much higher ranges are possible if the detector is illuminated by a remote visible or IR light source. Can be used at very low light levels, and even in total darkness with IR LED. Full information provided. The IC only is worth $16! Our price for the assembly is:

$6 ea. or **5 for $25**

FM MICROPHONE

Features a stainless steel case and an UNIDIRECTIONAL microphone insert, powered by two "AA" batteries. High quality at:

$28

JOYSTICK CONTROLS

Brand new good quality Japanese made joystick controls with four 100K pots attached. Great for computers, audio amplifiers, laser pattern generators etc.

$3 ea. or **4 for $10**

LASER GUN SIGHT

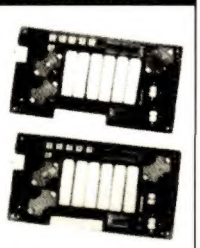
A 5mW gunsight at a super reduced price.

$229

Includes one "Free" rifle or pistol mount.

TUNING FORK PCB CLEARANCE

Each one of these identical PCB filter assemblies contains six three terminal tuning fork filters (IN-GND-OUT) at different frequencies in the audio range: 1.8-3.1KHz. These high quality dual tuning fork filters have very narrow bandwidths, and could be used in selective call systems, oscillators etc. Each PCB also contains two high current GAS ARRESTORS which sell for about $20Ea.! CLEARANCE AT:



$10 For a pair of identical PCB assemblies.

SWITCH MODE POWER SUPPLIES

Brand new Australian made complete assemblies consisting of a large PCB on an "L" shaped aluminium heatsink: Overall dimensions 260 X 230 X 70mm: Large! 110/240V input: Outputs +5V, −5V, +12V, −12V. Circuit provided. We have no further specifications, but calculate the outputs to be approximately 3.5A at +12V, 4A at −12V, 4.5A at −5V and 23A at +5V.

LIMITED STOCKS **$25**

SOLAR CHARGER

Use it to charge and or maintain batteries on boats, for lighting, solar powered electric fences, etc. Make your own 12V-4W solar panel. We provide four 6V-1W solar panels with terminating clips, and a PCB and components kit for a 12V battery charging regulator and a three LED charging indicator. See March 93 S.C. Incredible value!

$42

6.5Ahr. Panasonic gel battery $35. Electric fence PCB and all onboard components kit $40: See S.C. April 93. **The panels can be purchased seperately at $9Ea. or 4 for $32, or 10 for $70.**

IR LASERS

REDUCED PRICES! This precision collimator assembly is supplied with a brand new laser diode to suit. Produces a well collimated laser beam at 780nM/5mW. Barely visible. We also supply a PCB and components kit plus instructions, for a suitable digital driver circuit that can be used to complete the laser transmitter. Suitable for communications, data links, perimeter protection, barcode reading, medical use, etc.

$69

We can also supply a similar kit which includes a laser diode, unmounted lens, and a driver kit **$39**

EL-CHEAPO LASER

Probably the cheapest visible red helium neon laser and power supply ever offered, ANYWHERE! The kit includes a PCB, transformer, and all the components needed to make a 12V operated laser power supply, and a used laser tube with a power rating in the 0.5-2mW range. The PCB and all the onboard assembly is the same as the one used in our EHT Generator (it also now comes with a PCB), but a few extra necessary components and corresponding instructions are provided with the kit. Incredible value at:

$50

For the 12V inverter kit and a visible red laser tube. The EHT generator kit is available separately for $23.

BATTERY CLEARANCE

Famous "high-spec" GATES brand dual cell batteries, enclosed in a plastic moulding: 4V-5AHr per pack. Connect 3 packs in series to obtain a 12V/5AHr battery. Brand new, fresh stock, fully charged. LIMITED STOCKS at a **GIVEAWAY PRICE** of:

$10 ea. or **3 for $27.**

COMPUTER KEYBOARDS

New 54 key TI keyboards. Unencoded matrix type with edge connector (15 connections). All switches are SPST momentary with the exception of the "Alpha lock" key (Latching). Features cursor control keys, a function key, enter & shift keys, and a control key. Very LIMITED QUANTITY:

$14

PHOTOINTERRUPTER

An IR LED and an phototransistor in a slotted PCB mounting assembly. The phototransistor responds to visible and IR light. The discret components are easy to seperate as the assembly clips together. Great for IR experiments

$2 ea. or **10 for $15**

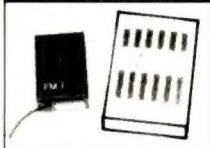
INDUCTIVE PROXIMITY SWITCHES

These industrial quality detectors will detect ferrous and non-ferrous metals at close proximity. Some are DC powered (10-30V), some are mains AC powered, and all will switch loads directly. All have three wires for connecting into circuitry: Two for the supply, and one for switching the load. LIMITED SUPPLIES.

ON SPECIAL AT

$22 ea. or **6 for $100**

MINIATURE FM TRANSMITTER



Not a kit, but a very small ready made self contained FM transmitter enclosed in a small black metal case. It is powered by a single small 1.5V silver oxide battery, and has an inbuilt electret microphone. SPECIFICATIONS: Tuning range: 88-108MHz, Antenna: Wire antenna — attached, Microphone: Electret condenser, Battery: One 1.5V silver oxide LR44/G13, Battery life: 60 hours, Weight: 15g, Dimensions: 30 X 20 X 10mm. Some would call this a miniature "BUG" and sell it for much more than our price of:

$32

LOW COST MICROPHONE INSERTS

Standard Electret Omnidirectional insert.....$1.20
Stage quality Unidirectional electret insert.....$6
Low cost Unidirectional Dynamic insert.....$4
Stage quality UNIDIRECTIONAL Dynamic insert.....$9

BUY 10 or more of any of the above inserts (mixture OK) and subtract 20% OFF the total cost.

IMAGE INTENSIFIER TUBE AND NIGHT VIEWER KIT

These 18mm image intensifier tubes are similar to ones used in night vision equipment during the Gulf War. They are ex-military and may have some minor blemishes on the viewing screen. With suitable low light lenses they will produce good vision in as little as starlight illumination. The tubes require a 3V battery to make them operational.

$490 for the tube only

The viewer illustrated was made using some low cost plastic tubing and matching fittings, a low light camera lens, and an eyepiece. We can supply a custom machined kit of parts (Mostly aluminium) for our latest casing: This kit includes everything except the front lens and the battery. The eyepiece is included.

$98 for the case kit without the front lens

The lens we used is a 50mm "C" mount f1.4 video lens, for a 1" format (Cosmicar type: B5014A) and we will supply details of a supplier of this lens: Approx. $130.

OATLEY ELECTRONICS

PO Box 89, Oatley, NSW 2223

Telephone: (02) 579 4985 Fax: (02) 570 7910

MAJOR CARDS ACCEPTED WITH PHONE AND FAX ORDERS

P & P ANYWHERE IN AUSTRALIA FOR MOST MIXED ORDERS: $2.50-$10

X-25 PACKET TESTING FOR BASIC RATE SERVICES

Features

- Circuit Mode Testing on Basic Rate Access Interface
- Physical Line Testing
- Protocol Testing
- B-channel Quality Measurement
- Battery Powered, Compact
- Packet Mode Testing

X—25

X—25

X—25

X—25

X—25

READER INFO NO. 40

Anritsu

ALCATEL

AUSTRALIA

MELBOURNE - 58 QUEENSBRIDGE STREET
SOUTH MELBOURNE, VICTORIA 3205
TELEPHONE : (03) 694-6666
FAX : (03) 694-6667